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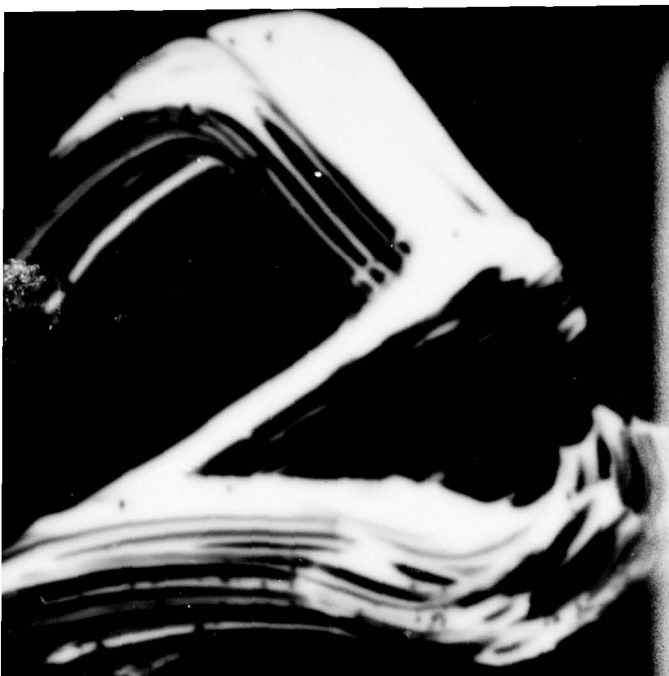
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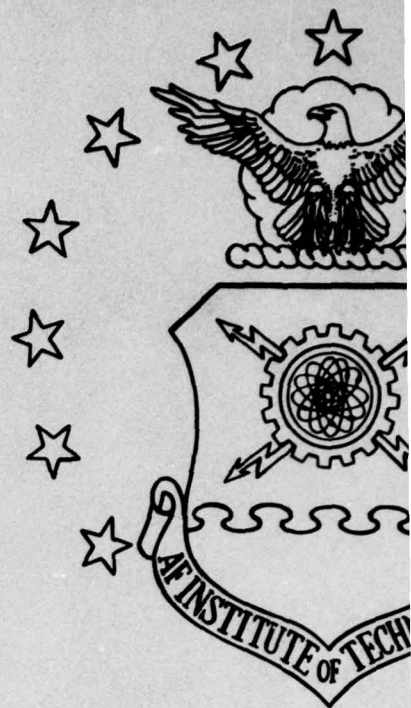
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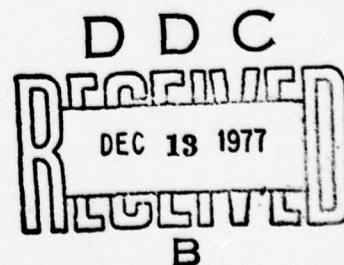
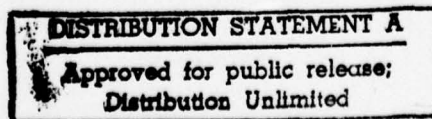
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IMPROVING THE COMMUNICATION
EFFECTIVENESS OF CIVIL ENGINEERING
MANAGEMENT PROCEDURES

Michael P. Melby, GS-12
Paul J. Palcic, GS-13

LSSR 18-77B



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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER AFIT-LSSR-18-77B	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) IMPROVING THE COMMUNICATION EFFECTIVENESS OF CIVIL ENGINEERING MANAGEMENT PROCEDURES.	5. TYPE OF REPORT & PERIOD COVERED Master's thesis,	
6. AUTHOR(s) Michael P. Melby, GS-12 Paul J. Palcic, GS-13	7. PERFORMING ORG. REPORT NUMBER	
8. PERFORMING ORGANIZATION NAME AND ADDRESS Graduate Education Division School of Systems and Logistics Air Force Institute of Technology, WPAFB, Oh	9. CONTRACT OR GRANT NUMBER(s)	
10. CONTROLLING OFFICE NAME AND ADDRESS Department of Research and Administrative Management (LSGR) AFIT/LSGR, WPAFB, OH 45433	11. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS	
12. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	13. REPORT DATE Sep 77	
	14. NUMBER OF PAGES 171 (12) 186p.	
	15. SECURITY CLASS (of this report) UNCLASSIFIED	
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE	
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES APPROVED FOR PUBLIC RELEASE APR 1967. JERRAL F. GUESS, CAPT, USAF Director of Information		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) AIR FORCE CIVIL ENGINEERING JOB KNOWLEDGE WRITTEN COMMUNICATIONS PROCEDURE WRITING READABILITY MANAGEMENT COMMUNICATION		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) See reverse.		

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BLOCK 20.

In recent years, the improvement of employee job knowledge, as a prerequisite for efficient and effective performance, has been an important goal of Air Force Civil Engineering managers. In this thesis the authors report on their investigation of the clarity and readability of written instructions as factors which influence job knowledge. Using carefully selected effective-writing techniques, ~~they re-wrote~~ ^{WAS RE-WRITTEN} a portion of the Civil Engineering procedure manual ^{IT WAS} for real property maintenance management. ^{for} They then compared ~~its~~ ^{its} communicability with that of the current procedure manual by administering a job knowledge test to a sample of civil engineering employees. A Gunning Fog Index measurement and an opinion survey were also used to determine the differences between the two versions of the manual. Although additional research involving larger samples will be needed to verify the findings, the authors found that all three measures used converged in the same favorable direction. The findings indicated that, for the population studied, the clarity and readability of written instructions did influence job knowledge, and that the writing techniques used in the re-written manual produced a higher level of job knowledge than did the currently used narrative writing style. ↵

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IMPROVING THE COMMUNICATION EFFECTIVENESS OF
CIVIL ENGINEERING MANAGEMENT PROCEDURES

A Thesis

Presented to the Faculty of the School of Systems and Logistics
of the Air Force Institute of Technology
Air University

In Partial Fulfillment of the Requirements for the
Degree of Master of Science in Logistics Management

By

Michael P. Melby, BS
GS-12

Paul J. Palcic, BS
GS-13

September 1977

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This thesis, written by

Mr. Michael P. Melby

and

Mr. Paul J. Palcic

has been accepted by the undersigned on behalf of the faculty of the School of Systems and Logistics in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN LOGISTICS MANAGEMENT

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ACKNOWLEDGEMENTS

We wish to express our sincere appreciation to our thesis advisor, Lt Col Ronald E. Knipfer, for his guidance and direction throughout this research effort. In addition, appreciation is expressed to Mr. Andrew A. Allan, 2750 CES/DE, for his assistance and advice. We are also indebted to the Air Force Human Resources Laboratory, with special thanks to Mr. John J. K. Klesch and Dr. Donald L. Thomas, for their technical guidance and support. A final note of gratitude must go to Dottie Huey, whose typing skill and technical expertise were indispensable. To our wife Sharon and Judy, this thesis is dedicated. Their efforts, patience and understanding deserve special recognition.

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Chapter 1

THE PROBLEM AND ITS SETTING

This chapter introduces the problem for research and explains the purpose and importance of the research study. It also presents the research objectives, scope and hypothesis, and describes assumptions and terms as necessary.

STATEMENT OF THE PROBLEM

The problem for research was to investigate possible causes of inadequate job knowledge in the civil engineering functional area.

IMPORTANCE OF THE RESEARCH

Job knowledge at base level in the civil engineering functional areas was not adequate. In a letter to all Major Commands (26:1-2), Major General Robert G. Thompson, Director of Engineering and Services, Headquarters USAF, advised that inadequate job knowledge was a serious problem. The Civil Engineering and Services Management Teams (CESMETs) found indications of inadequate job knowledge even on second and third visits to an installation. General Thompson said that "there is no way

we can make our base level operations truly effective until management, especially middle management, knows its job, and does it." He posed the solution of this problem as a "significant challenge" to Air Force Engineering and Services and expounded his strong belief that "much of our future success depends on how well we meet this challenge." Some management officials had decided that inadequate training was a cause of the inadequate job knowledge and had initiated action to improve and expand existing training programs (4; 27:1).

While the adequacy of training is one factor that affects job knowledge, there are also many other factors involved. Examples are: employee motivation, employee capability, time availability, and the clarity and readability of written instructions (1:18). The possibility existed that inadequacies in one or several of these factors also contributed significantly to the job knowledge problem, perhaps to an even greater extent than training inadequacies.

Researchers have suggested that inadequate job knowledge and consequently inadequate job performance in the Air Force logistics field was caused by a gap between the readability of directives and the reading ability of the employees. It has been recommended that additional research be conducted to find ways of reducing the reading

level of these directives in order to narrow the readability/reading ability gap (13:55-8).

OBJECTIVES

The objectives of this research effort were:

1. To determine if the clarity and readability of written instructions contributed to the problem of inadequate job knowledge in the civil engineering functional area, and
2. To develop and test a means of improving the clarity and readability of written instructions so that job knowledge could be improved.

SCOPE

Many factors would have required investigation if all of the significant causes of inadequate job knowledge in civil engineering were to have been determined. However, this research was limited to a study of the clarity and readability of written instructions. The investigation was focused on a single source of such instructions, Air Force Regulation (AFR) 85-1, Resources and Work Force Management (3; 23; 28). The testing of job knowledge improvement was confined to a single Air Force base.

RESEARCH HYPOTHESIS

The research plan for accomplishing the objectives involved the investigation of the following research hypothesis:

Application of existing techniques for the organization, formatting, and writing of procedures would improve the effectiveness of AFR 85-1 in the communication of job knowledge.

ASSUMPTIONS

The assumptions necessary for this research were:

1. that AFR 85-1 would continue to be a source of job knowledge in the civil engineering functional area, and

2. that a single reading of AFR 85-1 would not be sufficient for an employee to commit to memory all of the information needed to constitute his job knowledge.

Therefore, there was a need to refer back to AFR 85-1 periodically to locate specific information.

TERMS EXPLAINED

Job Knowledge

The term job knowledge as used in this research means information relating to administrative and

management systems and procedures as contained in AFR 85-1. An employee is considered as possessing job knowledge if he can reproduce the correct information from memory or is able to quickly locate it in a reference document.

Readability

Readability is that characteristic of a written document which relates to the ease or difficulty of reading and understanding it.

Chapter 2

A REVIEW OF THE RELATED LITERATURE

The communication of management policies and procedures is frequently ineffective (22:vii). The purpose of this chapter is to explore the literature and compile in summary form what can be considered the state-of-the-art in the field of effective manual development. In this review of the literature the term "manual" will be used to represent either policy manuals or procedure manuals or combination policy and procedure manuals. AFR 85-1 will be viewed as the equivalent of a policy and procedure manual. Let us begin by reviewing the purpose and need for manuals.

PURPOSE AND NEED FOR MANUALS

Basically, manuals are a form of communication used to transmit management decisions regarding organization, policies and procedures (1:240). Many corporation executives have indicated that although it is possible to function without an office manual, they have witnessed considerable improvement in efficiency and effectiveness when manuals were introduced into organizations which were trying to function without them. Optimum performance

cannot be achieved unless policies and procedures are reduced to writing, they are distributed and explained to the personnel involved, and compliance is enforced (1:19).

James G. Hendrick, director of the Systems and Procedures Services Department at Columbia Broadcasting System, Incorporated, identified ten distinct purposes or benefits of manuals. They are to:

1. communicate management information in a downward direction,
2. serve as an on-the-job reference guide,
3. assist the indoctrination of new employees,
4. assist in supervisory and executive training,
5. clarify the organization structure and delineate responsibilities,
6. achieve uniformity in the interpretation and administration of policies,
7. interface and coordinate related activities,
8. facilitate the elimination of duplication of efforts and duplication of activities,
9. provide a means for constant review and improvement of policies and procedures, and
10. provide a basis for internal auditing of policies, procedures and controls (16:240-41).

Alternate methods to achieve the purposes of

manuals are being researched in the hope of reducing costs and improving effectiveness. These include the dissemination of policy and procedural information by use of audio and audio-visual techniques. There is some possibility that in the future, manuals may be used to provide only outline formats with the details being provided by other media (16:260-61).

PROBLEMS WITH MANUALS

Now let us turn to an examination of how well manuals are meeting the needs. Many complaints are often heard both from procedure writers and managers about operating personnel failing to comply with procedures. Leslie Matthies (18:21) indicated that "most systems manuals are not useful ... because they are written from the wrong viewpoint!"

Typical of the complaints and criticisms about manuals are these few examples:

1. poorly organized and hard to follow,
2. too bulky,
3. information not up to date,
4. too detailed and ambiguous to be understood,
5. there should be separate manuals for policies and procedures,
6. poor arrangement, making it difficult to find

specific subject matter,

7. too complex and wordy,

8. too abstract - fail to get down to "brass
tacks,"

9. hard to read because of too many pages of un-
broken type - not enough headings (1:17-19; 2:554-55).

J. C. Aspley summarized the problems with manuals succinctly when he said "If it isn't clearly and concisely written, attractive, and easy to use, all the selling in the world won't make it effective (2:555)." Matthies summarized the problem in an even more simple form when he asked "Do we expect people in our organizations to study ... forms or procedures? (19:40)," and with his statement "The great pity of a manual that misses its mark ... and most of them are poor ... is that the need for the information remains (18:23)." One additional observation by Matthies during his research was that "Most of the people admitted that they needed information and wished that the procedure manual could give it to them. The need was there but the manuals did not satisfy this need (19:19)."

TECHNIQUES FOR EFFECTIVE MANUAL WRITING

While the literature indicates a need for manuals and attests to the fact that most manuals fail miserably

in meeting these needs, it does not idly criticize and then leave the manager with no way to communicate his decision to the operating levels. In this section integrated summaries of the literature on various human factors considerations which influence effective manual writing will be presented.

Understand Your Reader

Dr. M. Scott Meyers, writing in the Journal of Systems Management on the relationship of awareness and writing effectiveness said: "The work ethic has been going through a dramatic change in recent years. In order to be able to communicate effectively, we should be aware of ... [the] changing boundaries in our society." Consequently, a system can be most effective if the people affected by it agree with it, are involved with it, can influence it, and can control it (21:26).

Two reasons why communication attempts frequently do not succeed are (1) the problem of writers assuming background knowledge that the reader does not have, and (2) the problem of differing interpretations of the same word or phrase by different readers (11:39-40). In this vein, Walter Jablonski, in a test of one hundred and thirty-eight participants "discovered" that there are twenty-one meanings for the word applicable, thirty-eight

for universal, and forty-six for axial (12:29-40).

Besides word-meaning differences and background variations, Matthies pointed out that if there are several layers of supervision involved in the system being described, it may well take several layers of procedures to clearly communicate the system to each layer, or the resultant manual may not fit any of the layers (19:53-4).

Use The Appropriate Level of Readability

The readability of documents and manuals is significantly affected by writing style. In evaluating writing style, certain mental factors need to be considered such as: word comprehension ability, the ability to visualize the acts or conditions described, and the ability to follow the "thread" of a detailed presentation. These mental capabilities are much more developed in some individuals than in others. For this reason, skill is required in presenting material at the level of the average person the writer is trying to reach. It should not be presented at the writer's level of comprehension, nor at a level to please the writer's boss or uphold the organization's "image." Unless instructions are written for the intended audience, with their limitations and mental abilities in mind, their use will be inefficient.

Furthermore, if there is an inescapable need to address several levels of understanding within the organization in a single document, it is recommended that the level of difficulty be oriented to the lowest level of understanding that will be exposed to the material. In such cases, definitions should be liberally used (1:18).

Simplify The Style

The main task in presenting instructions is to simplify them. Four techniques for simplification are:

1. Use mainly words with which the audience is familiar.
2. Use short sentences; avoid those which are wandering or involved.
3. Replace passive verbs with active verbs (action words).
4. Avoid density of ideas (22:55-9).

Familiar words. Word choice is vital to written communications. Simple words are bold and clear, and usually convey the intended meaning. However, some writers never use a simple word if they know a more impressive one of similar meaning. Such a practice tends to weaken communication. Benjamin Franklin stated this technique very simply: "Never use big words when little ones will do (25:133)."

Short sentences. Writing should be broken down into understandable units - short paragraphs and short sentences that are concentrated on specific points. Monotony is thus avoided and the writing is more effective (9:157). Clear sentences are one of the most helpful ingredients of understandable writing. Although some variety in sentence length is desirable, short sentences are normally preferred. One researcher advised that no sentence should exceed twenty-five words in length (25:133). Another suggested that fifteen words constitute the maximum attention span (6:87). In any case, unity, coherence, and correct sentence structure are more readily achieved in short sentences than in long complex ones (25:133).

Active verbs. Active rather than passive verbs should be used. People speak with active verbs as a natural part of their language. Therefore, using active verbs when writing is getting to the level of the employees - speaking their language. Using active verbs also helps to achieve a natural forcefulness with inherent strength. Instructions are thereby presented in such a way that compliance is not demanded nor begged; it is simply taken for granted (22:62).

Avoid density. To avoid "density" of ideas or facts, additional words can be introduced into the text to permit a period of transition between ideas. Density is thereby decreased and the reader is able to use his abilities to understand on his own level rather than the writer's level. When trying to decrease density, however, care must be taken not to confuse the idea that is being communicated (22:66).

Consider Using Decision Logic Tables

A decision logic table (DLT) is basically an information layout technique whereby "conditions" and "actions" are arranged in a matrix format. The conditions and actions are also placed in a logical sequence to insure their completion in an orderly manner. This form of presentation allows the reader to quickly obtain the information he requires without being forced to read through other unrelated narratives. Several sources advise that decision logic tables are an excellent means for the effective communication of procedures to all levels within organizations, from top management to the clerical work force. Decision logic tables are more effective than narrative descriptions because:

1. they are easier to comprehend,
2. they more easily lend themselves to

standardization, and

3. their structure tends to influence organization of the procedures into a set of relatively independent procedures (8:11; 10:3).

The proponents of the decision logic table technique advise that whenever appropriate the decision logic table should be utilized, since it will invariably produce a regulation or directive of greater clarity and accuracy than the narrative technique would produce (20:94-5). One researcher summarized the case for the use of DLTs this way:

It is not enough to be able to write so that you can be understood. You must write so that you cannot be misunderstood. With this philosophy many organizations are abandoning the traditional narrative procedures in favor of decision logic tables. Decision tables force the breaking of the procedure into the smallest logical components. The conditions upon which actions are based are identified and logically organized to depict every pertinent cause and effect relationship. Consequently the procedure will more completely cover the situations that might arise in day to day operations [20:145].

Because of the benefits offered by the use of DLTs, some components of the Air Force, Army, Marine Corps, Coast Guard, Navy, and many civilian agencies in the Government are now issuing regulations in decision logic table format (20:94-5).

Consider Using The "Play-script" Technique

Those who have done basic research on the

readability of writing have learned that a reader will understand better if he can "see" people in the writing. The playscript technique was devised from the combined result of research into procedures and other fields of communication, and research in the general field of writing and its readability. Its developers indicate that playscript wasn't invented, but rather, that the techniques evolved out of a series of studies, experiments, and restudies. Playscript is a procedure-writing technique that "brings procedures to life" - one that does the job that a procedure is intended to do. In this technique the time-proven methods of the playwright are used. That is, each person is told the part he is to play. A playscript procedure contains the following five basic characteristics:

1. The procedure is a device that tells how to proceed.
2. It covers one definite, single cycle of action.
3. The action steps are written in a logical sequence.
4. People receive the action.
5. The procedures address work-groups (19:82-5).

Organize Effectively

The development of manuals involves a substantial investment in most large organizations. Considering the

investment required to prepare a manual, literature sources advise that it is appropriate to devote at least several months to planning the contents of the manual, item by item. The approach to the development of a comprehensive organization-wide manual may include the development of a list of subjects by functions and the discussion of each of the subjects with the appropriate organization executive. A list of required subjects should be developed, and priorities should be determined (16:247).

The writer of a manual should not try to combine too much information. If separate manuals are necessary to properly communicate ideas they should be used. The "combining" enthusiasts are prone to optimize conservation of paper at the expense of clarity and readability.

A study of procedures revealed that writers often try to do too much with their procedures. They were influenced by those who wanted to be economical with paper, but they turned out something that was of no value. About all that can be said for them is that they did save paper (19:52-3).

One of the first and most important items to be decided on when writing a manual is the particular arrangement of contents which will be adopted. Many manual writers use a conservative format, listing contents

alphabetically or combining similar items. Others prefer a numbering system which gives some order to the subject matter and makes it easier to refer to procedures. Although the numbering system has certain reference advantages, it can become rather complex and detract from a manual's readability (16:32-3). Problems have also been noted with another organizing technique - that of "grouping." Manuals that are written by grouping like-procedures do not communicate better. Most of those who have experimented with the grouping concept have abandoned it shortly thereafter (19:34-5).

Leslie H. Matthies found that by mixing policy and procedure (the what and the how) in the same manual, the value of the manual in providing clear guidance in either area diminished considerably. He suggested that when the policy statements exceed a sentence or two they should be published separately, and distinctly identified as policy (18:58-60; 19:23).

Develop a Good Index

Once information has been gathered and arranged, the writer needs to insure that the individual who uses the manual will be able to find the information he needs when he needs it. A proper index will make the information readily available; however, many manuals have been found to be poorly indexed. One source indicated that in

a sampling of manuals, many indexes were found to be far out of date. In other cases, the procedures were found to be poorly indexed because the writers had evidently depended entirely on the titles as the basis for reference. In these cases, when a title was not descriptive of the discourse, it was almost impossible to find in the index what was actually being looked for in the manual (19:59-60).

An index is a mental door, a way for the user to get into the manual for the information he needs. Subject titles are not sufficient keys to open these doors. A properly developed index will point the way to information that is in the body, but may not be reflected in the subject title alone. The individual using the index is not interested in reading a procedure clear through; he is just interested in an answer to his immediate question (18:114).

Contrary to tradition, one source advised that the index should be placed in the front of the manual. He also suggested that the index should be brought up to date at least every six months. Furthermore, if for some reason a large number of changes are distributed at one time, the manual index should be revised and reissued at that time (18:111).

Consider Human Factors In The Layout

The term layout is used in manual writing to describe the arrangement of the text on the page. Layout also refers to the headings used, their space occupancy and location, and the size of type. Layout starts with a blank, white sheet of paper. By the way the printed words are put on that sheet the reader can be attracted or repelled. Therefore, to be effective as a communications device, the final document should look pleasing and inviting to the reader and be designed with human factors in mind (22:14).

One such consideration is the use of "white space." The appropriate use of white space can make a significant difference in eye appeal. For example, if inadequate white space is allowed, the solid copy with narrow margins and crowded paragraphs repels the reader. Conversely, wide margins and liberal amounts of white space in between logical groups of paragraphs "open the copy up" for the reader (18:80-1). Additionally, the liberal use of subheadings will supply an outline and reference guides for the reader (6:86).

Type size and style are also important considerations in aiding or hindering the effectiveness of manuals. The reason is that both affect the amount of effort required to actually read the words. The writer, therefore,

should be conscious of the effect of both type size and style (22:32).

Another important consideration in layout is line length. Short lines of type are easier to read than long lines. This is true because a person reads most easily when the eyes pick up an entire line with one sweep. This ability of the eye to sweep up words and their meaning is limited. If the line is long, the eye cannot take the entire line in one sweep. Therefore, the meaning cannot be grasped unless two or three sweeps are made on one line. The reader then tends to lose his place on the line and skips down to the next line or up to the line he has previously read (18:82). Proper line length depends on the size of type, the spacing of type and the spacing of lines. The rule to follow is: the smaller the type and the closer the spacing, the shorter the line should be (22:42).

The size of margins and line length are closely related. Research has shown that line length should be kept to six inches or less. When using pages eight and one-half inches wide this will leave a two and one-half inch margin. One inch of this margin should be on the outside edge and the rest should be in the gutter or the binding margin (22:46).

Layout also plays an important role in the playscript technique. In playscript, the headings are set

apart from, but next to, the text to which they refer. The playscript technique is being increasingly used by manual writers. With no text to interrupt the eye as it scans a column of headings, reference is quick and easy. The use of playscript requires more care in planning and writing, but those who use it are high in its praise (1:38).

One final consideration regarding layout is the use of illustrations. The liberal use of illustrations is recommended. One source (17:32) indicated that the use of cartoons or other illustrations "break up" the text and make it more "palatable."

Tailor The Format

In an experiment examining how easily the same basic information could be used when presented as (1) bureaucratic style prose, (2) flow chart or algorithm, (3) a list of short sentences, or (4) a two dimensional table, prose was always slower to use and more error prone than the others. Easier problems showed no difference in error rates, although the table was used most rapidly. For more difficult problems, the algorithm gave the fewest errors. Differences in retention appeared, however, when subjects worked from memory. Here, performance with prose and short sentences continued to improve over repeated trials, whereas performance with both the algorithm and

the table deteriorated. It was concluded that the optimal format for written information depends on the conditions of use (30:160).

PERSUASION AND ACCEPTANCE

In addition to use of effective writing techniques, manual writers need to bear in mind that in one way or another the manual must be "accepted" by those who are intended as its users. The intended users must be convinced that some benefit will accrue to them by complying with the procedures. One way of communicating "persuasion" is to explain in the manual, along with the procedures, the purpose or reasons why certain actions should be taken. The inclusion of such philosophy or background, however, violates the principle of simplicity. This situation presents a challenge to the procedure writer of how to sell the manual and at the same time keep it simple.

A solution to this dilemma may lie in the maintenance of simplicity in the procedure, and by explaining the purpose by an alternate technique such as a training program.

Experience has shown that when a new or revised manual is introduced with some formal training - classroom type preferred - it gets wider and quicker acceptance from the employees who will use it. Time spent in such training may mean the difference between failure and success in the presentation of the new manual [2:552].

EVALUATION OF THE LITERATURE

This search of the literature disclosed that many techniques exist which can be used to improve the communications clarity of manuals. The selection of which techniques to use in attempting to improve AFR 85-1 took into consideration the specific types of information contained in AFR 85-1.

AFR 85-1 is a combination of policy and procedure. The procedures involve a considerable amount of interaction between various jobs and many of the procedures involve complex decision processes.

Of the techniques identified in the literature search, two seem to be most applicable to AFR 85-1. They were the playscript technique and the use of decision logic tables (DLTs). Playscript is most useful for interactive types of procedures which AFR 85-1 has many of. DLTs are most useful for complex decision situations which AFR 85-1 also has many of. Although each of these two techniques is advanced as being complete in themselves, it was determined that a combination of the two would best fit the requirements of AFR 85-1.

Playscript and Decision Logic Tables, therefore, were the techniques used to test for improvement of the communications clarity of AFR 85-1. Some other minor techniques such as the use of action verbs, short

sentences and improved organization techniques such as separation of policy from procedure were also incorporated into a re-written version of AFR 85-1.

Chapter 3

THE DATA AND TREATMENT OF THE DATA

This chapter describes the data, the research methodology, and how the data were treated, analyzed, and evaluated.

THE DATA

The basic data for this research consisted of primary data. They were composed of scores from job knowledge tests administered for the express purpose of gathering data for this research.

THE RESEARCH METHODOLOGY

This research was conducted as an experimental study. The actions involved were to:

1. Re-write Chapter 6 of AFR 85-1 using selected effective-writing techniques as described in the Evaluation of the Literature section of Chapter 2. The re-written Chapter 6 is presented in Appendix A. For comparison, a copy of the current version of Chapter 6 is presented in Appendix B.
2. Develop a job knowledge test covering the Optional Procedures Section of Chapter 6.

3. Administer the job knowledge test to a random sample of employees from a large midwestern Air Force Base.

4. Compare the average test scores attained, to determine if the use of the experimental AFR 85-1 produced higher scores.

5. Statistically test the differences in scores to determine if the results could be generalized to the population.

6. Determine Fog Index (see appendix G) values for both versions of AFR 85-1 to provide an additional measurement of readability differences.

7. Administer and evaluate an opinion survey to provide qualitative data for additional insight.

SPECIFIC TREATMENT OF THE DATA

The Data Needed

The data needed to investigate this problem were two sets of job knowledge test scores. One set of scores measured the amount of job knowledge attained by employees who used the current AFR 85-1 as their source of job knowledge. The second set of scores measured the amount of job knowledge attained by employees who used the experimental AFR 85-1 as their source of job knowledge. These data are interval level data.

The Means Of Obtaining The Data

The data were obtained by administering a job knowledge test to a random sample of civil engineering employees who, collectively, were representative of the people at the test site with a need to use AFR 85-1 on their jobs.

The Data Collection Instrument

The data collection instrument used in this research consisted of a two-part job knowledge test. The test was developed and administered in two parts to facilitate use of an experimental design technique known as the double change-over design (7:317). The two parts of the test were designed to be, and were assumed to be, of equal difficulty. A complete copy of the test is presented in Appendix C.

The test instrument was similar, in format and content, to tests previously used by the Civil Engineering and Services Management Evaluation Teams (CESMET) and the AFLC Inspector General (IG) to measure job knowledge in the civil engineering functional area (3; 22). The test content, however, was limited to material presented in Section C, Chapter 6 of AFR 85-1.

Although the test instrument itself was similar to job knowledge tests previously used in the civil

engineering functional area, the administration of this test experiment differed from previous test situations in several aspects. In this experiment the test was administered as an "open book" test. Also, in addition to recording the correct answer, the test subjects were required to record the page number where the answer was found in the reference material. The requirement to also record the page number was designed to minimize the effects of pre-existing knowledge by requiring the subject to be able to physically locate the answer in the reference document. Recording of the page number was also intended to reduce guessing by the test subjects. It was realized that by administering the test as an "open book" test only one aspect of job knowledge would be measured. In other words, although job knowledge in this research is considered to include "remembered" job information and "readily located" job information, the open book/page number characteristics of the test measured only readily located job information. Time constraints on both the researchers and test subjects precluded the additional manual re-writing, test development, manual reading, learning, and test taking that would have been required to also test remembered job knowledge. Additionally, in testing the remembered job knowledge area, pre-existing knowledge would have been much more difficult to control.

The validity of the test as an accurate, unbiased measure of the true difference in communicability of the two versions of AFR 85-1 was difficult to assure. This was because of the need for the same individuals who accomplished the re-writing of AFR 85-1 to also develop the test. In order to help minimize the possibility of bias, the test was submitted to a group of professional researchers in the Human Resources Laboratory at Wright-Patterson AFB for their comments prior to its use. Their evaluation was that the test did not seem to be biased in favor of the experimental AFR 85-1, and if in fact any bias existed it would appear to be in favor of the current AFR 85-1 (15).

The Population

The population investigated in this study consisted of all civil engineering employees of a large mid-western Air Force Base with a need to use AFR 85-1 as a direct source of job knowledge (approximately 200 personnel). The population included enlisted and commissioned military personnel, and civilian personnel in grades WS-10 through 17 and GS-5 through 14. These personnel held such positions as foreman, planners, schedulers, controllers, and section and branch chiefs.

The Sample

A simple random sample of thirty-four subjects was selected from the population. The sample was considered as representative of the population because even though the population was heterogeneous with respect to many characteristics, the random selection assured equal probability of selection of each of the characteristics.

The Data Collection Plan

The data were collected by administering the job knowledge test to the selected subjects.

Prior to selection and testing, permission was obtained from the Deputy Base Civil Engineer to conduct the testing experiment.

Then, the population was enumerated by screening the civil engineering personnel rosters to select by job title those personnel who were judged to have a need to use AFR 85-1 as a direct source of job knowledge. The population was then sequentially numbered and a random sample was identified by using a random number table (5: Table N). The first three digits of each random number were used; those random digits greater than the total number of the population were ignored.

The subjects were notified of their selection to participate in this experiment by letter, through their supervisory channels. A copy of the notification is

found in Appendix D.

Prior to commencement of the test the subjects were randomly divided into two groups, Group A and Group B. The double change-over technique was used to increase the precision of the experiment (7:317). It is believed that use of this technique helped assure that equal reading ability and comprehension were applied to both the experimental AFR 85-1 and the current AFR 85-1, and therefore helped strengthen the internal validity of the experimental data.

The double change-over experimental technique was applied as follows:

1. Group A was given Part I of the job knowledge test with the current AFR 85-1 as their source of job knowledge. They then were given Part II of the test and the experimental AFR 85-1.

2. Then Group B was given Part I of the test and the experimental AFR 85-1 and then they were given Part II of the test and the current AFR 85-1. This resulted in the current and the experimental versions of AFR 85-1 each being tested by both parts of the test. Coded pairs of Parts I and II of the test were given to the same individual to provide a means of "pairing" the data. The tests were scored on a percentage-correct basis. Either the incorrect answer or the incorrect page number caused the

response to be scored as incorrect. Both groups were given the same instructions regarding the conduct of the test. Appendix E presents the text of these instructions.

Analysis Of The Data

The data were compared to determine if the mean (average) of the test scores attained using the experimental AFR 85-1 as a source of job knowledge was higher than the mean of the scores attained when using the current AFR 85-1.

Statistical significance of difference. A statistical test of the difference between the means was then performed to determine if the difference could be attributed to the source of job knowledge, or if the difference was due to chance or sampling error. A one-tailed Student's t test of paired data (29:171-3) was used for this statistical test because it is the most appropriate test of the difference between means when the same subjects are observed under different conditions (see Appendix F). This was the case in this experiment. The following assumptions are necessary when using this statistical test:

1. The data is paired.
2. The population variance, σ^2 , is unknown.
3. σ^2 is the same for both samples.
4. The distribution of the sample means for the population is normal.

The null hypothesis tested was:

$$H_0: \mu_x \leq \mu_y$$

The alternate hypothesis was:

$$H_1: \mu_x > \mu_y$$

Where μ_x is the population mean of test scores obtained when using the experimental AFR 85-1 as the source of job knowledge and μ_y is the population mean of the test scores obtained when using the current AFR 85-1.

The five steps necessary for the statistical test were:

1. The data were arranged such that all the experimental AFR 85-1 test scores were in one column and the current AFR 85-1 test scores were in a separate column.
2. The differences (D_i) between the experimental AFR 85-1 test scores (X) and the current AFR 85-1 test scores (Y) were computed.
3. The differences between paired Xs and Ys were summed and the mean difference (\bar{D}) was computed.

Where:

$$\bar{D} = \frac{1}{n} \sum_{i=1}^n D_i, \text{ and}$$

n = number of subjects.

4. The standard deviation of \bar{D} , $S_{\bar{D}}$ was computed.

Where:

$$S_{\bar{D}} = \frac{\sqrt{\frac{\sum_{i=1}^n (D_i - \bar{D})^2}{n-1}}}{\sqrt{n}}$$

5. The test statistic (t_s) was computed and compared to t critical (t_c), where $t_s = \bar{D}/S_{\bar{D}}$. The t_c was determined by using the Student's t distribution (5:Table J) with n-1 degrees of freedom at the desired α level, in this case $\alpha = .05$. An α of .05 was selected so that H_0 would be rejected when it is in fact true only five times out of one hundred. This level of significance was considered more than adequate for the purposes of this experiment (24:91-7).

ADDITIONAL DATA

As additional data, the readability of the two versions of AFR 85-1 was determined, and an opinion survey of the participants in the experiment was conducted. These data were not necessary for investigation of the research hypothesis but it was believed that such data would provide additional insight. These additional data

may also allow generalization of the conclusions from the experiment beyond theoretical constraints imposed by the limited population in the job knowledge test.

Readability

The Gunning Fog Index, which is a commonly used measure of readability, was used for this measurement. (See Appendix G for a more detailed description of the Fog Index.) The Fog Index provides a measure of readability which is roughly equivalent to the years of schooling a person would need to read the material with ease and understanding (7:426-7).

From each of the two versions of AFR 85-1 five random samples of one hundred words or more were taken. The samples for each of the versions of AFR 85-1 were aggregated, and the Fog Index criteria was applied.

Opinion Evaluation

To obtain some qualitative insights regarding the merits of the experimental writing techniques, an opinion evaluation survey was given to each participant at the conclusion of the test. A copy of the survey questions is provided in Appendix H.

Chapter 4

RESULTS AND ANALYSIS

This chapter presents the results and an analysis of the:

1. job knowledge test experiment,
2. Gunning Fog Index, and
3. opinion evaluation.

JOB KNOWLEDGE TEST EXPERIMENT

Thirty-four subjects were randomly selected to participate in the job knowledge test experiment. The subjects were divided into two equal groups (A and B). Group A was scheduled at 1300 hours on a Wednesday afternoon and Group B was scheduled at 1430 hours that same day. Thirteen of the seventeen subjects from Group A showed up to participate in the experiment. Only ten of the seventeen subjects from Group B showed up and one of those left half way through. Therefore, a total of twenty-two participants completed the experiment.

Data Base

The test scores for Groups A and B are presented in Table I. The scores indicate the percentage of questions answered correctly by each participant. Detailed

TABLE I
JOB KNOWLEDGE TEST SCORES

(Percent of questions answered correctly.)

<u>Subject</u> (Group A)	<u>Part I</u> (Current AFR 85-1)	<u>Part II</u> (Experimental AFR 85-1)
1	45	90
2	55	65
3	45	25
4	50	40
5	40	55
6	75	50
7	95	95
8	35	45
9	5	30
10	40	25
11	55	50
12	65	90
13	60	40

(Group B)	(Experimental AFR 85-1)	(Current AFR 85-1)
14	30	15
15	40	35
16 *	90	--
17 **	85	70
18	25	5
19	25	10
20	65	50
21	55	45
22	40	50
23	50	60

* Score not used due to incomplete participation.

** Participant finished 6 minutes early using the experimental AFR 85-1 and 1 minute early using the current AFR 85-1.

test results are presented in Appendix I.

Analysis

An analysis of the test results showed that for all participants, the overall mean test score obtained using the current AFR 85-1 was 45.68%. The overall mean score, for all participants, using the experimental AFR 85-1 was 50.68%. There was an increase of 5.00 percentage points in the overall mean test score when the experimental AFR 85-1 was used as a reference. This equates to an increase of approximately 11% in measured job knowledge.

However, not all participants' scores increased when the experimental AFR 85-1 was used. Overall, 59% of the participants attained higher scores when using the experimental AFR 85-1. They had a mean increase of 17.31 percentage points. On the other hand, 36% of the participants attained lower scores. They had a mean decrease of 14.38 percentage points. The remaining 5% attained equal scores with both versions of AFR 85-1.

Another point of view would be to look at the percentage change as opposed to differences in percentage points. From this viewpoint, the mean percentage increase for those who attained higher scores with the experimental AFR 85-1 was 47.37 percent. Conversely the mean percentage decrease for those who attained lower scores with

the experimental AFR 85-1 was 35.94 percent. Detailed mean scores by group are presented in Table II.

TABLE II
MEAN TEST SCORES BY GROUP

	<u>Group A</u>	<u>Group B</u>	<u>Overall</u>
Mean Score Current AFR 85-1	51.15	37.78	45.68
Mean Score Experimental AFR 85-1	53.85	46.11	50.68
Percent Improvement	5.28 *	22.05	10.95

* computed as: $[(53.85 \div 51.15) - 1] \times 100$

Test Of Statistical
Significance

The data from Table I were rearranged to facilitate application of the paired t-test. The rearranged scores are presented in Table III such that all scores from the experimental AFR 85-1 appear in column 2 and all scores from the current AFR 85-1 appear in column 3. Using the methodology described in Chapter 3, the remainder of Table III was computed and the test statistic (t_s) was computed as 1.328. The critical statistic (t_c) was extracted from statistical tables for the Student's t distribution

($\alpha = .05$, one-tail) as 1.721. As additional data, t_c for $\alpha = .10$ is 1.323.

TABLE III
COMPUTATIONS FOR STATISTICAL
ANALYSIS OF TEST SCORES

1	2	3	4	5	6	7
Subjects	Test Scores Experimental AFR 85-1(X)	Test Scores Current AFR 85-1 (Y)	D_i	\bar{D}	$D_i - \bar{D}$	$(D_i - \bar{D})^2$
1	90	45	45	5	40	1600
2	65	55	10	5	5	25
3	25	45	-20	5	-25	625
4	40	50	-10	5	-15	225
5	55	40	15	5	10	100
6	50	75	-25	5	-30	900
7	95	95	0	5	-5	25
8	45	35	10	5	5	25
9	30	5	25	5	20	400
10	25	40	-15	5	-20	400
11	50	55	-5	5	-10	100
12	90	65	25	5	20	400
13	40	60	-20	5	-25	625
14	30	15	15	5	10	100
15	40	35	5	5	0	0
*16	--	--	--	--	--	---
17	85	70	15	5	10	100
18	25	5	20	5	15	225
19	25	10	15	5	10	100
20	65	50	15	5	10	100
21	55	45	10	5	5	25
22	40	50	-10	5	-15	225
23	50	60	-10	5	-15	225
TOTAL	1115	1005	110			6550

$$\bar{X}=50.6818 \quad \bar{Y}=45.6818 \quad \bar{D} = 5$$

* Scores not used due to incomplete participation

Analysis Of The Test For
Statistical Significance

The hypothesis tested was:

$$H_0: \mu_x \leq \mu_y$$

$$H_1: \mu_x > \mu_y$$

Where the null hypothesis (H_0) was that the mean test score attained using the experimental AFR 85-1 (μ_x) is less than or equal to the mean test score (μ_y) attained by using the current AFR 85-1. The alternate hypothesis (H_1) was that μ_x is greater than μ_y . In this test t_c (1.721) was greater than t_s (1.328). Therefore, there is insufficient evidence to reject H_0 at the 95% level of significance. Application of this test at the 90% level of significance ($\alpha = .10$) results in t_c (1.323) less than t_s (1.328). Therefore, at the 90% confidence level, H_0 can be rejected and H_1 can be accepted.

GUNNING FOG INDEX

In accordance with the methodology described in Chapter 3 and the description of the Gunning Fog Index presented in Appendix G, sample Fog Indexes were computed.

Data Base

Fog Index computations for the original version of AFR 85-1 are presented in Table IV. Fog Index computations for the experimental version of AFR 85-1 are presented in Table V.

TABLE IV
FOG INDEX, CURRENT AFR 85-1

<u>Beginning Para Number</u>	<u>Number of Words</u>	<u>Number of Sentences</u>	<u>Number of Words With 3 Syllables or More</u>
6-13i	126	3	16
6-14b	132	6	21
6-14d(1)(a)	106	6	22
6-14d(1)(e)	104	4	14
6-15b(13)	<u>152</u>	<u>6</u>	<u>19</u>
TOTALS	620	25	92

Average words per sentence = $620 \div 25 = 24.8$

Number of words with 3 syllables or more, per 100 words =
 $92 \div \frac{620}{100} = 14.8$

Fog Index = $(24.8 + 14.8) 0.4 = 15.8 \approx 16$

TABLE V
FOG INDEX
EXPERIMENTAL AFR 85-1

<u>Beginning Para Number</u>	<u>Number of Words</u>	<u>Number of Sentences</u>	<u>Number of Words With 3 Syllables or More</u>
6-9.8	125	10	7
6-9.14	106	10	15
6-11.2	174	25	6
6-13.5	131	12	5
6-19.4	<u>101</u>	<u>9</u>	<u>11</u>
TOTALS	636	66	44

TABLE V (CONTINUED)

Average words per sentence = $636 \div 66 = 9.6$

Number of words with 3 syllables or more, per 100 words =
 $44 \div \frac{636}{100} = 6.9$

Fog Index = $(9.6 + 6.9) \times 0.4 = 6.627$

Analysis

The Gunning Fog Index of a passage is considered to be a rough equivalent of the years of schooling a person would need to read the passage with ease and understanding.

The computed Fog Index for the current AFR 85-1 is approximately 16th grade while the Fog Index for the experimental AFR 85-1 is 7th grade.

OPINION SURVEY

After completion of both parts of the job knowledge test, the test subjects were asked to stay a few more minutes and complete an opinion survey. All twenty-two of the participating subjects completed the survey form which was coded to their respondent numbers on the job knowledge test. The complete text of the opinion survey is presented in Appendix F.

Data Base

Questions one through six of the opinion survey required the respondent to place an X along a continuum

of opinion possibilities. The continuum was found to be difficult to evaluate on an aggregate basis. Therefore, it was necessary to translate the responses into discrete data. This translation was accomplished in the following manner:

1. Each side of the neutral point along the continuum was divided in half.
2. The two outer line segments were considered "unfavorable" or "favorable."
3. The inner line segments were considered "unfavorably inclined" or "favorably inclined."
4. The neutral point was considered as indicating no difference.

Questions 1-6. The results of questions one through six are presented in summary form in Table VI. Table VII presents these data in greater detail and in relation to test scores.

TABLE VI

OPINION SURVEY RESULTS

Unfavorable	(U)	Unfavorably Inclined	(UI)	No Difference	(ND)	Favorably Inclined	(FI)	Favorable	(F)
9%		0%		18%		27%		45%	
14%		0%		9%		32%		45%	

1. CLARITY: Rate the clarity of the experimental version of AFR 85-1 for your on-the-job needs, compared to the current version of AFR 85-1.

2. DECISION LOGIC TABLES: Compare the decision logic tables (the boxes with "IF" headings) with the narrative technique used in the current AFR 85-1.

TABLE VI (CONTINUED)
OPINION SURVEY RESULTS

Unfavorable	(U)	5%	Unfavorable Inclined	(UI)	0%	No Difference	(ND)	5%	Favorably Inclined	(FI)	9%	Favorable	(F)	82%
-------------	-----	----	----------------------	------	----	---------------	------	----	--------------------	------	----	-----------	-----	-----

3. FORMAT: Regarding the unusual format of the experimental version of AFR 85-1, did you find that having the person responsible shown in the left hand column and the actions in the right hand column makes it easier to find information than in the current AFR 85-1?

TABLE VI (CONTINUED)
OPINION SURVEY RESULTS

	Unfavorable	Unfavorably Inclined	No Difference	Favorably Inclined	Favorable
	(U)	(UI)	(ND)	(FI)	(F)
4. Disregarding the cost of rewriting, how much better would it be if all applicable Air Force manuals and regulations were rewritten using the new writing techniques?	14%	0%	5%	14%	68%
5. Disregarding the cost of rewriting, how much better would it be if all applicable local operating instructions (OI) and (SOPs) were re-written using the new writing techniques?	5%	0%	5%	23%	68%

TABLE VI (CONTINUED)
OPINION SURVEY RESULTS

Unfavorable	(U)	9%
Unfavorably Inclined	(UI)	5%
No Difference	(ND)	5%
Favorably Inclined	(FI)	41%
Favorable	(F)	41%

6. Based on the number of questions you answered on Part I and Part II, how do you feel about the validity of this experiment as an evaluator of the benefits of the new writing techniques?

NOTE: Percents may not add to 100 due to rounding.

TABLE VII
INDIVIDUAL OPINION SURVEY RESULTS
COMPARED WITH TEST SCORES

<u>Subject</u>	<u>Test Scores</u>			<u>Opinion Evaluation</u>					
	<u>Exp.</u>	<u>Curr.</u>	<u>Difference</u>	<u>Question Number</u>					
				<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>
1	90	45	45	F	F	F	F	F	F
2	65	55	10	FI	FI	F	FI	FI	FI
3	25	45	-20	FI	FI	F	F	F	F
4	40	50	-10	FI	FI	F	F	F	FI
5	55	40	15	ND	ND	F	F	F	F
6	50	75	-25	F	F	F	F	F	ND
7	95	95	0	F	F	F	F	F	FI
8	45	35	10	F	F	F	F	F	F
9	30	5	25	FI	FI	F	F	F	FI
10	25	40	-15	ND	F	F	FI	F	FI
11	50	55	- 5	FI	F	F	F	FI	FI
12	90	65	25	FI	F	F	F	F	F
13	40	60	-20	ND	U	ND	ND	ND	UI
14	30	15	15	F	FI	F	F	F	F
15	40	35	5	ND	F	FI	FI	FI	FI
*16	--	--	--	--	--	--	--	--	--
17	85	70	15	F	FI	F	U	U	U
18	25	5	20	U	U	FI	U	FI	FI
19	25	10	15	U	U	U	U	FI	U
20	65	50	15	F	F	F	F	F	FI
21	55	45	10	F	F	F	F	F	F
22	40	50	-10	F	ND	F	F	F	F
23	50	60	-10	F	FI	F	F	F	F

* Did not complete survey

Key

Unfavorable (U)
No Difference (ND)
Favorable (F)
Favorably Inclined (FI)
Unfavorably Inclined (UI)

Question 7. When asked "Would you like to see the entire AFR 85-1 written in the new format? Why or why not?"

Those who liked the new format said:

"Yes, I believe that personnel involved in meeting the mission and using 85-1 could be able to agree on processing work better than is being done at the present time."

"Yes - localizing of duties of individuals is easier to understand."

"Yes - spending the same amount of time studying, I would much prefer the new format. It is more understandable and it is easier to locate what you need, especially when you do not use 85-1 every day."

"Reference to questionable procedures is more readily accessible."

"Yes"

"Yes. One of the current reg's weaknesses is cross referencing to related information. Rewrites by USAF have helped some, however the new technique should do an even better job."

"The new format is much faster and more interesting to read - information is readily available - no unnecessary stumbling to locate immediate needs."

"Yes - Time saving."

"Yes"

"Yes - Would make finding the answers easier."

"Yes ..."

"Partially - Step by step processing would be fine - However, policy matters should be narrative to allow managerial flexibility."

"Yes ..."

"If rewritten, would be very helpful in the step-by-step process of job orders and related material."

"Yes - It clearly defines each person's responsibilities under a given situation and also a clear flow of paperwork."

"Yes - Because it is much easier and faster to find the information your [sic] looking for without having to read the whole book."

"Yes - Currently I find it difficult to follow 85-1. New version, at least in Chap 6, seems simpler."

Those who did not like the new format had this to say:

"Probably I was a little confused."

"No, I found it more difficult to work with."

The remaining three subjects did not answer this question.

Question 8. When asked "Is there anything about the experimental version of AFR 85-1 that 'turned you off' or 'turned you on' as far as wanting to use it rather than

the current AFR 85-1?"

Those who were "turned on" by some aspect of the experimental version said:

"Experimental version was clear, easier to understand and easy to use."

"Plus factor was its simpler format which should simplify becoming familiar with it. Also, once familiar with it, it should become even more useable as a reference."

"The ease of locating information as needed would be very enhancing and time saving."

"The format turned me on regarding wanting to use it."

"I liked the format of the re-written version, made it easier for me to find the answers."

"The clarity of the new version turned me on."

"I found the index much better."

Those who were "turned off" by some aspect of the experimental version said:

"The time limit turned me off. " This individual mentioned that he could have used more time to become familiar with the experimental version.

"I like 85-1 as it is. The problem with all regs and manuals are [sic] the double talk."

"The forms were not listed as of usage."

"You must understand it first."

The remaining eleven subjects did not respond to this question.

Question 9. When asked "Do you have any suggestions about how to improve the experimental version of AFR 85-1?"

There were fewer responses to this question but those who made suggestions had this to say:

"... there is still too much cross referencing."

"... format could be changed to include forms ... in closer proximity to the subject matter."

"... incorporate ... smaller examples of forms ... show what was added to the form at that point ... incorporate office symbols with titles."

In addition, five respondents used this question to complain about the conduct of the experiment. They made comments to the effect that insufficient time was allowed to become familiar with the new version.

Analysis

Responses to questions 1 and 2, which dealt with the clarity of experimental AFR 85-1, indicated that approximately 75% of the subjects thought that the experimental version of AFR 85-1 was more clear than the current version.

Responses to question 3 revealed that 91% of the subjects thought that it was easier to find information

in the experimental AFR 85-1.

Responses to questions 4 and 5 revealed that approximately 85% of the subjects thought that it would be better if all applicable Air Force manuals, regulations and local operating instructions were re-written using the new writing techniques.

Results of question 6 are considered inconclusive in view of several narrative comments and verbal comments made by the subjects at the end of the test period.

The narrative comments received in response to questions 7 and 8 indicated a favorable reaction to the re-written version in terms of clarity, ease of use, and eye appeal.

The narrative comments received in response to question 9 indicated the absence of major design flaws in the experimental AFR 85-1 but indicated minor discontent with the placement of figures and form facsimiles.

Chapter 5

SUMMARY, DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

This chapter presents a summary of this research, a discussion of weaknesses in the research, conclusions drawn from analysis of the data, and recommended areas for operational consideration and further research.

SUMMARY AND FINDINGS

This section relates the results obtained with the specific research objectives and the research hypothesis.

Research Objective 1

Statement of the objective. Research objective 1 was to determine if the clarity and readability of written instructions contributed to the problem of inadequate job knowledge in the civil engineering functional area.

Summary of results. The results of the job knowledge test showed an overall mean increase of 11% in the participants' ability to find the correct answers to job related questions when the experimental AFR 85-1 was used as a reference. The test for statistical significance of the

difference between means shows a statistically significant difference in favor of the experimental AFR 85-1 at the 90% confidence level. The Gunning Fog Index, as a measure of readability, showed an improvement of nine "grade levels" in the readability of the experimental AFR 85-1 as compared with the current AFR 85-1. In the opinion survey, 72% of the participants responded either "favorable" or "favorably inclined" when asked if the experimental AFR 85-1 was superior in clarity to the current AFR 85-1.

Findings. Since a more clear and more readable version of AFR 85-1 produced a higher percentage of correct answers on a job knowledge test, it can be said that the clarity and readability of written instructions does contribute to the problem of inadequate job knowledge in the sample groups.

Research Objective 2

Statement of the objective. Research objective 2 was to develop and test a means of improving the clarity and readability of written instructions so job knowledge could be improved.

Summary of results. In the development of an experimental version of AFR 85-1, the two main techniques used were the playscript procedure technique and the decision logic

table technique. During the rewrite process, in addition to producing a more clear and more readable set of procedures, it was learned that the use of these techniques forces the writer to be more specific and complete. For example, when using either the playscript or the DLT technique, an incomplete procedure loop or cycle becomes extremely obvious to the writer. This encourages him to complete the loop or cycle, whereas in the narrative format, such a condition could easily go unnoticed.

The test of the "experimental writing techniques" showed that the sample group performed an average of 11% higher when they used the experimental AFR 85-1. Improved scores were achieved by 59% of the participants. These participants improved their scores by 47% by using the experimental AFR 85-1.

Findings. The experimental writing techniques "force" the writing of a more complete set of procedures, and the test results showed that higher job knowledge resulted from the new procedures. Therefore, it can be said that the new way of writing improved the job knowledge of the test group.

Research Hypothesis

Statement of the hypothesis. The application of existing techniques for organizing, formatting, and writing would

improve the effectiveness of AFR 85-1 in the communication of job knowledge.

Summary of results. The existing playscript and DLT techniques were applied to part of Chapter 6 of AFR 85-1. A job knowledge test comparing this experimental version of AFR 85-1 with the current version of AFR 85-1 using twenty-two participants and a two-part test administered under the double changeover experimental technique produced scores 11% higher when the experimental AFR 85-1 was used.

Findings. For the portion of AFR 85-1 which was rewritten, the effectiveness in the communication of job knowledge to the sample group was increased by 11%.

DISCUSSION

Weaknesses

Despite the efforts of the researchers to be thorough, time constraints and other factors resulted in several weaknesses in this research study. The following weaknesses became apparent as research progressed:

1. Demographic data was not collected, which might have given some indication of common characteristics existing among those participants who did well and those who did poorly on the job knowledge test.

2. The questions used on the job knowledge test were taken directly from the current version of AFR 85-1. This was done to insure that the test was not biased in favor of the experimental AFR 85-1. However, this effort to prevent bias may have had the opposite effect - that of biasing the test in favor of the current AFR 85-1.

3. Perhaps inadequate time was allowed for familiarity with the experimental version of AFR 85-1. The five minutes allowed for scanning the experimental AFR 85-1 prior to the test is contrasted with months or years of familiarity with the current format of AFR 85-1. One might expect that as additional familiarity with the experimental format were gained, a continued improvement in communication effectiveness would result.

4. There was a marked difference in the percentage of those who did well on the experimental version of AFR 85-1 and those who commented favorably on the opinion survey. In fact, several participants who scored lower with the experimental AFR 85-1 thought it was clearer and easier to use than the current version. There are no data available to resolve this contradiction. However, one might suspect that it was caused either by:

- a. a "halo" type of effect wherein the participants may have responded on the opinion survey in the way they thought the researchers wanted them to respond, or
- b. the test experiment may not have adequately

evaluated the merits of the experimental version of AFR 85-1.

5. Although the effect on the experiment can not be measured, it appeared that many of the participants were not highly motivated. This was believed to be the case because several participants made no attempt to use the familiarization period for either the experimental AFR 85-1 or the current AFR 85-1 prior to taking the test. Additionally, the high incidence of incorrect page number responses indicated the possibility of guessing rather than looking up the correct answers. The anonymity of the participants may have been an influencing factor.

6. The design of the test questions gave approximately equal weighting to three different "search categories." These search categories are:

- a. Given a job title, find what task the individual is to perform.
- b. Given a task, find out who is to perform the task.
- c. Non-person-oriented questions.

The knowledge of which search category was most frequently used would have allowed weighting the test more heavily toward that search category. The authors believe that search category a. (Given a job title, find what task the individual is to perform) is most predominant under actual operating conditions.

7. Inadequate attention was paid to keeping the groups of equal size. In order for the double change-over experimental design technique to eliminate biases of unequal intelligence of group members or unequal tests, the groups given the test must be of equal size. In the experiment, Group A consisted of 13 subjects while Group B consisted of only 9 subjects. Analysis of the test scores of these groups suggests that Part II of the test may have been more difficult than Part I. Since Group A, with 13 subjects, used the experimental version to answer the potentially more difficult test (Part II), the double change-over technique would offset this bias only if there were 13 subjects in Group B that would use the experimental version on the supposedly easier test (Part I). Since there were only 9 subjects in Group B the double change-over technique did not eliminate this possible bias.

8. The test did not contain a sufficient number of questions. One individual in Group B completed and turned in Part I, using the experimental AFR 85-1, six minutes ahead of the twenty minute time limit. This individual also completed and turned in Part II, using the current AFR 85-1, one minute early.

Corrections

Of the weaknesses or unfavorable factors discussed above, only items 7 and 8 could be mathematically

corrected. When the appropriate corrections were made using average group performance and correct answers per minute to correct weaknesses 7 and 8 respectively (see Appendix J for computations), the statistical test for significance of the difference in means showed significance at the 95% confidence level. This is a substantially higher level of confidence than indicated by the raw data. Furthermore, with these corrections the mean improvement becomes 15% instead of 11%.

CONCLUSIONS

Based on the research results presented above, for the population which was investigated it can be concluded that:

1. the clarity and readability of written instructions contributed to the problem of inadequate job knowledge, and
2. the application of existing techniques for organizing, formatting and writing, specifically the playscript and decision logic table techniques, would improve the communications effectiveness of AFR 85-1 in communicating job knowledge.

RECOMMENDATIONS

This research showed that improvements in

communications effectiveness can be obtained by using the effective writing techniques found in the literature. However, the population investigated was not large enough to draw generalized conclusions for widespread application of the concepts. Further research is therefore recommended. This additional research can be approached from several points of view:

1. by the application of techniques used in this research to a broader population of subjects,
2. by the application of techniques used in this research to a broader population of manuals, and
3. by the application of additional or other effective writing techniques.

This additional research could be conducted either within an academic environment, or by an operating agency in the field. For this additional research, the following guidelines are offered:

1. The playscript and decision logic table techniques investigated in this research appear to be applicable for the presentation of procedural information. This is particularly true in cases where the procedures incorporate a significant flow of work between individuals or organizations. The playscript technique although good for procedures, does not appear to be suitable for the presentation of policy type material. The decision logic

table technique, although it was not investigated for policy type actions in this research, is advanced by the literature as being useful in presenting some types of policy information (20:94-5). Since many Air Force regulations and manuals appear to contain the type of interaction that is contained in AFR 85-1, the potential area for improvement is large.

2. Obviously, the scope of this research did not allow exhaustive testing of all available effective writing techniques. Other techniques included in the literature search (presented in Chapter 2) should be investigated, as well as other techniques not described in that literature review. One possibility, for example, would be to add a third column to the playscript format to permit separation of the "what" from the "how." This "dual level" presentation approach was effectively used in job guide manuals for C-141 maintenance, and its use avoided the problem of a high level of detail being offensive to experienced personnel (15:26).

3. By tighter design and control attempt to prevent recurrences of weaknesses encountered in this research effort.

APPENDIX A

EXPERIMENTAL AFR 85-1

CHAPTER 6 - JOB ORDERS

SECTION A - GENERAL

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Chapter 6

JOB ORDERS

SECTION A -- GENERAL -- SYSTEM DESCRIPTION

6-1. PURPOSE OF THIS CHAPTER. This chapter describes the Job Order system and work organization techniques used to authorize work that seldom needs detailed planning.

6-2. JOB ORDERS.

a. DEFINITION. A Job Order (JO) is a document used to authorize simple work that often involves only one cost center. Most often it can be done without detailed planning and with little delay in obtaining supplies.

b. CONCEPTS.

(1) General. The JO system is an economical means to authorize and communicate work to craftsmen. It allows grouping of jobs and provides a choice to perform jobs singly or in work packages. Supply support must be timely in assuring that supplies are on hand or are easy to obtain, for civil engineering to get the most benefit from this system. Civil engineering bench stocks must be adequate in terms of proper line items and availability. To this end, each foreman, material control specialist, and civil engineering funds manager must apply concerted effort to assure the desired bench stock status (See Chapter 11.) JOs are performed using the SMART, FAST, Hopper or IWP technique.

(2) Use. The JO serves as a simple way to process jobs. It reduces paperwork because detailed planning is seldom needed and supplies are usually on hand. It may be used for single shop or multi-shop jobs. The JO conveys instructions on job location and scope for work not needing separate costing.

(3) Processing. JOs coming from phone calls, AF Forms 1135 (See figure 9-5) or inputs from CE personnel (foremen, craftsmen, and so forth, during normal course of work) will normally be processed using the Fast Action Service Technique (FAST) or by the Hopper technique of control and scheduling. FAST and Hopper JOs have one important thing in common; they are always collected by area and reviewed for possible grouping as a work package. Give careful thought to civil engineering manpower, supplies and vehicles needed, to insure the best use of resources.

c. COMPLIANCE ITEMS.

- (1) Restrictions on the Use of Job Orders. JOs will NOT be used to authorize:
- (a) MFH minor construction (class MC) with a total cost of \$100 or more.
 - (b) Construction on leased facilities. See chapters 7 and 9, and AFM 86-1.
 - (c) MC work costing more than \$500.
 - (d) MC work less than \$500 if it affects real property accountable records. The Chief of Programs ensures that all proposed MC work by JO is discussed with the Real Property function before authorizing the work.
NOTE: Be sure if a MC JO estimated to cost less than \$500 actually exceeds \$500, that a Work Order (AF Form 327) is prepared to replace the JO. Also, review to determine if the real property records need to be capitalized.
 - (e) Contract work, except contract maintenance services for repair of motors, compressors, and so forth, (EEIC 569, funds).
 - (f) Work or services performed for others chargeable to Cost Account Code 61000, Reimbursable Work and Services.
 - (g) Operations.
 - (h) Services, except individual requests for entomology services.
 - (i) Recurring maintenance as defined in Chapter 5.
 - (j) Work that must be capitalized in the real property records per AFM 93-1. This includes replacing RPIE in a facility or removing RPIE from one facility to put in another when the change requires capitalization.
 - (k) Work needing supplies not in one of the categories below:
 - 1. Authorized bench stock.
 - 2. Most current Stock Number Directory, unless it has a long lead time.
 - 3. Can be obtained from the standard supply system or COCESS within an acceptable period of time (45 days for CONUS and 90 for overseas).
 - 4. The Residual Material Holding Account. See AFM 170-27.
- (2) Job Order Authorization.
- (a) Use fully completed AF Form 1879, Service Call/Job Order Record to authorize FAST, Hopper and IWP JOs.
 - (b) Use fully completed AF Form 1219 to authorize SMART JOs and MFH renovation JOs.
 - (c) The Chief of Programs or his designee authorizes IWP, MFH renovation and SMART JOs. The Chief of Work Control or his designee authorizes all other JOs.

(3) Job Order Control.

- (a) Set up a system to number and control JOs using AF Form 1880, Job Order Log for IWP and SMART JOs. See Chapter 8 for numbering and control of other JOs.
- (b) Release JOs from the IWP on a monthly basis for scheduling.
- (c) Review the 1879 prior to the weekly scheduling meeting to identify extra supplies needed but not in bench stock.
- (d) JOs that need support from another cost center are discussed by the scheduler and proper superintendent to ensure all cost centers involved are given a JO if needed. Cross reference the JOs so controllers can schedule the work in sequence.
- (e) The controller signs JOs as completed. On JOs using large resources or of a sensitive nature the foreman initials in the "Initials" block on the controller's copy of the 1879 before the controller's sign off. The foreman's initials also show that left over supplies were processed per para 11-13.

(4) Job Order Work From Phone Calls. JOs produced by the Service Call specialist from phone calls, AF Form 1135, or sources in O&M, are reviewed by the Chief of Work Control. This review is for possible grouping with the current month Work Orders, scheduled SMART, Hopper or FAST work, current month IWP JOs or other planned work. He identifies items which can be grouped, (for example, "Do with Work Order 54321," "Do with the SMART visit to Bldg. 626 on 10 October," "Refer to FAST" and so forth,) and sends to the scheduler to put on the proper AF Form 561 and send to the controller.

(5) Cancellation.

- (a) JOs may only be cancelled by the same or higher level of authority that approved the document upon which the JO was based.
- (b) Develop procedures to assure accurate records and give proper notice to functions concerned with cancelled JOs.
- (c) Tell customers when JOs are cancelled.

6-3. IWP JOB ORDER TECHNIQUE.

- a. DEFINITION. This is used when the work requires supplies that must be ordered, or when it does not have to be done within 30 days.

6-4. FAST ACTION SERVICE TECHNIQUE (FAST).

- a. DEFINITION. A means of work performance using a team(s) of one or more craftsmen and one or more skills. They do minor maintenance and repair jobs which do not qualify as Service Calls (see Chapter 8) but which for common sense reasons should be done within 5 days.

b. **CONCEPTS.** Normally, assign one craftsman per skill to each truck. He may be civilian or military, but must be a tradesman able to do a variety of jobs with little supervision. The jobs are usually gathered by Work Control, grouped by task and area, and sent to a controller to assign within 2 to 5 days.

c. **COMPLIANCE ITEMS.**

- (1) Set up FAST team(s) to perform urgent, nonemergency maintenance and repair work, usually of 2 man-hours or less, on MFH and base facilities.
- (2) Vehicle. Provide a vehicle for each team.
- (3) Supplies, Tools, Equipment. Stock each FAST vehicle with the supplies, tools, and equipment needed to do the work. Mark contents on stock bins and refill from O&M cost center's bench stocks. The proper shop is to obtain tools for craftsmen.
- (4) Labor Reporting. Labor time accounting for FAST is done by the controller.

6-5. **HOPPER TECHNIQUE.**

- a. **DEFINITION.** A scheduling technique which collects work items by area or system and collates the work into packages by craft and facility.
- b. **CONCEPTS.** JOs which should be done within 30 days but do not qualify for FAST or SMART use the "Hopper" system. The idea is to use "Hoppers" set up for various areas of the base to collect work items. See figure 6-1. On a recurring basis of less than 1 month, extract the items from the hopper, gather the supplies needed, select skills needed and schedule through the controller.

6-6. **STRUCTURAL MAINTENANCE AND REPAIR TEAM (SMART).**

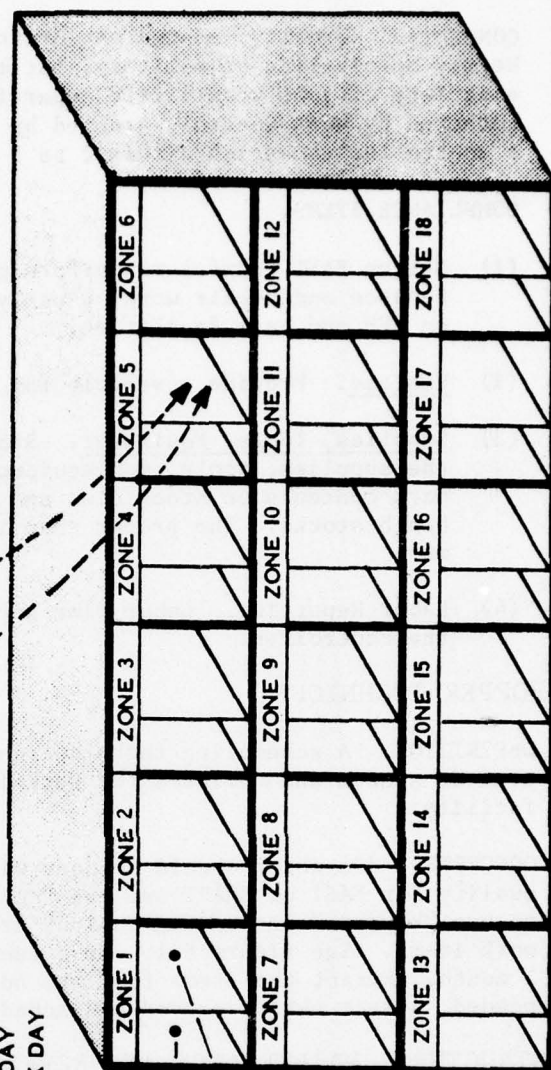
- a. **DEFINITION.** A team of craftsmen of various skills who perform routine minor maintenance and repair work on selected high use facilities on a recurring basis.
 - b. **CONCEPTS.** This method is used to do the work with minimum overhead and time lapse between identification and accomplishment. Minor maintenance and repair includes such items as replacing broken floor tile, touch-up painting, plumbing items such as faucet washer replacement and flush valve repair, and repair of broken electric outlets. In other words, typical "homeowner maintenance."
- (1) Operation. The SMART operates the same way as other O&M cost centers but it usually has a trailer and the workers report to the trailer. The SMART cost center could have one or more teams or trailers, based on local needs.

HOPPER & FAST ZONES

OCTOBER 1972						
SUN	MON	TUE	WED	THU	FRI	SAT
1	2	3	4	5	6	7
	1	2	3	4	5	
8	9	10	11	12	13	14
		6	7	8	9	
15	16	17	18	19	20	21
		10	11	12	13	14
22	23	24	25	26	27	28
		15	16	17	18	
29	30	31				

HOPPER-ZONE = WORK DAY
FAST - 6 ZONES = WORK DAY

NOVEMBER 1972						
SUN	MON	TUE	WED	THU	FRI	SAT
			1	2	3	4
			1	2	3	
5	6	7	8	9	10	11
	4	5	6	7	8	
12	13	14	15	16	17	18
	9	10	11	12	13	
19	20	21	22	23	24	25
	14	15	16	17	18	
26	27	28	29	30		



Fast

Hopper

Establish a Hopper for each work zone for collecting and consolidating work requirements. Divide the Hopper into a small section for FAST and a larger one for routine work. Bases may use any method desired to develop their Hoppers such as tub files or cabinets. The recommended method is shown. The hoppers should be near or adjacent to the Service Call room and Chief of Work Control office.

Figure 6-1. Hopper and FAST Zones

- (2) Is There a Need for SMART? The need varies. Each base has conditions which are the basis for a need or the lack of one. Most variable are items such as the size of the base, number of O&M craftsmen, condition of facilities, present success in keeping overhead low, and the delay between finding work and doing it.
- (3) Manning for SMART. Consider at least the variables in (2) above. Closely control to insure full use of craftsmen. Skill needs may vary over time. However, where past data confirms the need, take action through the local Management Engineering Team (MET) to include a position on the SMART UDL for each man-year needed in a certain craft. Reflect authorizations on Unit Detail Listings in Functional Account Codes for each of the crafts, that is codes 4451, 4452, and so forth. Set up authorizations in these codes for SMART if they are assigned to SMART more than 180 days per year. SMART manning may be increased by loans from other cost centers for short periods.
- (4) Types of Work Authorized. The SMART cost center does only minor work items which need only bench stock. SMART work is normally JO work; but, an Individual Work Order or Service Call should be done when the team is in a facility if it does not disrupt the SMART schedule.
- (5) Work Identification. Work is mostly preidentified by planning technicians on a predetermined schedule. To be effective, the SMART should follow the planning technician by not more than 10 days.
- (6) Control. The use of SMART for minor maintenance and repair needs in selected high use facilities can produce good results. But it can waste resources if not well managed. Managers must review the program often to assure that the work and the resources (supplies and labor) are kept in balance. Limiting SMART strictly to high use facilities; preidentification of work; adequate bench stocks; and using the schedules are the keys to program success.

c. COMPLIANCE ITEMS.

- (1) Establishment. Set up SMART as a new unit in the Structures Section with cost center code 457, organization structure code MEMCG and shop code MO. This does not imply a need for a distinct shop area or the need to assign other building space.
- (2) Manning. SMART will be composed of multicraft crew(s) under one supervisor. The supervisor will possess a seven level skill and should be in the 55XXX career field. The number of men needed, by craft and skill level, will be based on the scope and condition of the facilities chosen. Crew make up and size will be altered in response to varied needs.

- (3) Equipment.
- (a) Vehicle--Assign a vehicle to SMART from on hand assets, when a need on a full time basis is justified. If not, provide transportation on an as needed basis.
 - (b) Obtain trailer(s) through a request to the Base Equipment Management Office and receipted for on a custodian account.
 - (c) Tools--Technical tool kits are provided per TA 503. For portable tools and equipment use TA 403.
- (4) Supplies. Set up a new bench stock, using the shop code (MO), to support all trailers. Location of the bench stock is a local decision. Re-supply actions may be done at the central bench stock, at the trailers, or at a point which CE and base supply agree on. Primary concerns are ease of handling and maximum economy.
- (5) Facilities. Limit the choice of facilities for the SMART concept to high use facilities (dormitories, BOQs, open messes, dining halls, service clubs, theaters, and so forth) and those that have a history of frequent minor maintenance. Military family housing WILL NOT be maintained by SMART.
- (6) Facility Inspection Schedule. After the facilities and frequencies are selected, prepare an annual schedule by week. The schedule is mandatory and must be adhered to. The facility schedule must be continually reviewed to alter frequency of maintenance and to delete or add facilities where needed. The Planning function conducts facility inspections and prepares the 1219s.
- (7) Labor Reporting. The controller performs time accounting for SMART.

6-7. MILITARY FAMILY HOUSING (MFH) RENOVATION.

- a. DEFINITION. The maintenance and repair work performed in military family housing during a change in occupancy. This work is limited to that needed to restore the quarters so they can be promptly reoccupied.

SECTION B - MANAGEMENT PROCEDURES6-8. SETTING UP FAST/HOPPER WORK ZONES

(Initial set-up and annual review)

-
1. Selects sample from the Control Number Log (about one month's calls).
 2. Plots calls on a base layout map, placing a colored dot near the facility for which the call was placed. This will show the density of calls. Calls may be color coded by craft to provide further work/resource data for future management actions.
 3. Divides the base into 18 geographic work zones having about an equal amount of dots. Numbers the work zones.

NOTE: Some of the zones may be used for utility systems and other facilities which might cover more than one zone. When this is done reduce the number of zones on the base map. For example, if numbers are used for the electrical distribution system and the heating distribution system there would be 16 left to divide the dots.

4. Writes the zone number for each facility on the Service Call copy of the BCE Collection Work Order Number Listing (PCN N200367).

NOTE: No matter how many zones have been set up Hopper work in each zone should be scheduled once a month.

5. Yearly, reviews and updates zone areas. Adjusts zones if workload has changed to a great extent.

NOTE: This is to ensure that JO workload matches the zones.

SECTION C - OPERATIONAL PROCEDURES6-9. IWP JOB ORDERS: INITIAL PROCESSING

Chief, Program
Development

1. Selects, from sources below, items which should be done as IWP JOs (rather than as IWP Work Orders or other work techniques):
 - a. AF Forms 332.
 - b. AF Forms 1135.
 - c. Service Calls that can wait for routine action.
 - d. Routine work that comes from within CE (except SMART surveys).

2. Sends to IWP programmer.

IWP Programmer

3. Checks each item to see if it can be done with other work.
4. Tells the work authorization specialist when to prepare AF Form 1879 and which items to include.

Work Authoriza-
tion Specialist

5. Prepares 1879s, see figure 6-2.
6. Assigns a JO Number and a Collection Work Order Number to each JO.

NOTE: JO Numbers are not the same as Control Numbers put on Service Call, FAST and Hopper JOs by the Service Call specialist (see Chapter 8). JO Numbers begin with 1 each fiscal year for each cost center. Prefix the number with a shop code. Example: PB-1. Shop codes are in AFM 67-1, Vol II, Part II, Chapter 19.

7. If contract maintenance services are needed for repair of motors, compressors, etc., for RPIE, or EAID if a BCE responsibility:
 - a. Also prepares AF Form 9, Purchase Request, in coordination with the Chief of O&M/Superintendent. Requests Superintendent to verify that the item is not covered by warranty/guarantee (Chapter 14).
 - b. Enters Collection Work Order Number from the JO to the Form 9.

NOTE: See para 17-20 and AFM 70-4; EEIC 569/533 funds.

8. Logs JOs on AF Form 1880 by filling in cols A, E, G, and H. Also puts current date in col B (direct schedule), or C (minor construction), or D. See figure 6-3.

**Work Authoriza-
tion Specialist
(continued)**

NOTE: Keeps a separate 1880 for each IWP month, for each involved cost center, unless volume is small.

9. Sends 1879s to Planning.

Planner

10. Enters planning data and estimates.

NOTE: Plans only to the extent needed to convey instructions that will enhance efficient and economical performance.

11. Identifies needed supplies.

12. If supplies are not on hand but can be obtained through Supply within 30 to 45 days, prepares AF Form 1445.

NOTE: Use Bench Stock Listing, Stock Number Directory and/or COCESS Listing per AFM 67-1, Vol II, Part Two, Chapter 19.

13. If extra cost centers are needed to do the work:
a. Gets extra JO Numbers from the work authorization specialist.
b. Prepares extra 1879s as needed.
c. Cross-references each 1879 to the others.

NOTE: Multishop JOs must be limited to work that does not need close cost center interface.

14. Sends JOs, 1445s and other supporting papers to IWP programmer.

IWP Programmer

15. Verifies the IWP month of accomplishment and enters it in the "Estimated Completion Block" of the 1879.

16. Sends JOs and supporting papers to work authorization specialist.

**Work Authoriza-
tion Specialist**

17. If IWP month of accomplishment has been changed, updates 1880s.

18. Enters estimated manhours by JO in col F and date received from Planning in col I.

19. Gets authorizing signature of Chief of Programs or his designee.

20. If supplies are not on hand:
a. Assigns required delivery date (RDD) and coordinates with IWP programmer.
b. Sends JO and supporting papers to Material Control.

Work Authoriza-
tion Specialist
(continued)

- c. Enters date-to-Material Control in col J of 1880.
 - d. When supplies arrive, gets JO and supporting papers back from Material Control. Enters date returned from Material Control in col K of 1880.
21. For JOs with supplies on hand or not needed:
- a. Groups the JOs, including multishop JOs, to be done in the next month.
 - b. Sends to Chief, Work Control not later than 5 work days before end of the current month.
 - c. Enters date sent to Work Control in col L.

6-10. IWP JOB ORDER: SCHEDULING

Work Control

- 1. Gives IWP JOs to foreman at weekly scheduling meeting.
- 2. If a Multishop JO, checks with proper superintendents to insure all cost centers involved are given a JO if needed.

Foreman

- 3. Assures that needed bench stock and qualified craftsmen are available. If supplies are not on hand asks Material Control to request a bench stock fill.
- 4. Groups Hopper and IWP JOs that can be done at the same time. (Like work by same craft, and same building).

Scheduler

- 5. For JOs with all supplies on hand, lists IWP JOs separately on the back of AF Form 561.
- 6. Sends scheduled IWP JOs (duplicate copy), and copy of 561 to controller.
- 7. Sends IWP JOs (originals) and a 561 to foreman.

Controller

- 8. Schedules work per Chapter 12.

6-11. FAST/HOPPER: INITIAL PROCESSING

Service Call
Specialist

- 1. Gets calls, fills out AF Form 1879 (refer to para 8-15).
 - a. If emergency, follows Chapter 8.
 - b. If doesn't need action in less than 30 days, sends to IWP programmer.

Service Call
Specialist
(continued)

2. Tentatively codes as FAST (see figure 6-4), or Hopper (see figure 6-5). Tells customer expected date of completion. Enters zone number.

3. Sends to Chief, Work Control.

Chief, Work
Control

4. If skills not on hand, decides proper processing technique and processes that way.

5. If supplies are not on hand, asks Material Control to get bench stock fill.

6. Takes actions below:

IF ↓	AND IF ↓	THEN ↓
Work is needed in 2 - 5 days, and needs 2 man-hours or less.	If other work not scheduled within 5 days	a. Enters FAST LUC. b. If not marked FAST, changes. c. Enters estimate of crew size and total m/h. d. Signs in "Authorized" block. e. Puts in FAST bin.
	If other work scheduled in building within 5 days	f. Enters LUC of other work. g. Sends to scheduler, with a note to add to scheduled work.
Work is needed in 6-30 days	If other work is currently scheduled in building for shops or SMART	
	If other work not scheduled	h. Enters HOPPER LUC. i. If not marked HOPPER, changes. j. Puts in HOPPER bin.
Other		k. Identifies as IWP JO, Work Order, project, etc., and processes that way.

7. If work technique was changed, tells Service Call Specialist.

Service Call
Specialist

8. Tells customer of change in work technique.

Scheduler

9. Sends JOs from 6g above to controller.

6-12. FAST: SCHEDULING

- | | |
|------------------------------|--|
| Work Control | 1. Pulls one horizontal row of FAST JOs (six zones) from the Hoppers at the start of each work day. Sorts by skills. |
| | 2. Prepares two sets of work packages. Sends one set to FAST team leaders or cost center foremen, and the other to controllers. |
| Foremen or FAST Team Leaders | 3. Decides in advance if special skills, supplies or tools are needed. Prepares as needed. |
| | 4. Coordinates FAST jobs for next duty day with controller before the end of work day. |
| Scheduler | 5. Looks for backlogging of FAST jobs by the controller. If backlogged, insures no more work is added and advises Chief of Work Control. |
| Chief of Work Control | 6. Resolves backlogs by such actions as rerouting work to other work techniques. |

6-13. HOPPER: SCHEDULING

- | | |
|-----------------------|---|
| Work Control | 1. Gets AF Forms 1879 from proper hoppers before the weekly scheduling meeting. Sorts by skills. |
| Foreman | 2. If a certain craftsman should be given the job, writes "assign to (craftsman's name)" on 1879. |
| | NOTE: Do this only when necessary, in order to preserve controller flexibility. |
| | 3. Enters estimate of crew size and total manhours. |
| | 4. If supplies are not in bench stock or base supply annotates that fact and lists the supplies needed. |
| | 5. Sends all JOs to the Chief of Work Control. |
| Chief of Work Control | 6. If supplies are not on hand, decides to order the supplies and reschedule the job, or to send to Program Development to put in the IWP.
a. If put in the IWP, tells the customer. |
| | 7. Signs the 1879 in the "Authorized" block and sends to the scheduler. |
| Scheduler | 8. Adds up the estimated man-hours for each shop. Enters the shop totals for Hopper JOs as one |

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AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OHIO SCHO--ETC F/G 5/1
IMPROVING THE COMMUNICATION EFFECTIVENESS OF CIVIL ENGINEERING --ETC(U)
SEP 77 M P MELBY, P J PALCIC
AFIT-LSSR-18-77B

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2 OF 2
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NL



Scheduler
(continued)

line item on Part Two of Weekly Work Schedule.

9. Schedules JOs (including Hopper) per Ch. 12.

10. If total Hopper hours is large, sets up team.

NOTE: A work leader from lead shop supervises team. Craftsmen remain assigned to their own shop. Consider giving team a trailer stocked with supplies. Move the trailer from zone to zone with the team.

6-14. TO OBTAIN EXTRA SUPPLIES DURING WORK PROGRESS (FAST/HOPPER AND IWP)

Foreman

1. If the extra supplies needed are in bench stock, uses them to complete job.

2. If not, lists needed items on his copy of JO. Sends to controller.

Controller

3. Attaches his copy of JO to foreman's copy. Sends both to Chief of Work Control.

Work Control

4. Reviews.

IF	THEN
Long supply lead time	a. Sends JO to Program Development to put back in the IWP. b. Records this action in col M on 1880.
Short supply lead time	c. Sends JO to Material Control. d. Completes cols A thru G, and J on 1880. (See figure 6-6). e. Gets JO back from Material Control when supplies are in.

5. When short-lead-time supplies arrive:

IF	THEN
Manhours are Available	a. Enters date in col K on 1880. b. Sends JO through normal scheduling process.
Manhours are not Available	c. Writes "to PD". d. Notes "supplies on hand" on the JO if supplies are in holding area. e. Sends JO to Program Development for a future IWP month.

Program
Development

6. Tells customer of any change in work schedule.

6-15. ACTIONS UPON COMPLETION OF FAST/HOPPER AND IWP ORDERS

Craftsman

1. Tells controller the job is finished and number of manhours used.

NOTE: Discard shop copy of AF Form 1879 when work is finished.

Controller

2. Records man-hour data in lower portion of proper "LUC" block of 1879. Signs in "completed by" block. Enters date completed in "date" block.

3.

IF ↓	AND IF →	THEN →
FAST		a. Sends to scheduler.
Hopper	Came from Service Call Section.	b. Sends to Service Call Specialist.
	Came from Program Development.	c. Sends to work authorization specialist.
IWP		d. Puts proper LUC in "Luc" block. e. If the JO involves large resources or is of a sensitive nature, obtains foreman's initials in "initials" block. f. Sends to work authorization specialist.

NOTE: The foreman's initials verify that residual supplies were processed per para 11-13.

Scheduler

4. Sends completed FAST JOs to Service Call specialist.

Work Authorization Specialist

5. Enters current date in col M of AF Form 1880. Sends JOs to IWP programmer.

IWP Programmer

6. Reviews. Files per local methods.

6-16. SMART: INITIAL PROCESSING AND SCHEDULING

1. Develops facility survey schedule for high use facilities.

**Chief of
Programming**

2. Approves facility survey schedule. Sends to Chief of Work Control, scheduler, Service Call Specialist, and Planning.

Planner

3. Identifies "SMART" workload according to the schedule. Schedule is mandatory and must be adhered to.
4. Inspects buildings prior to the weekly scheduling meeting per schedule.
5. To do this inspection.
 - a. Reviews Facility Folder and Facility Number File.
 - b. Contacts the building occupant (building custodian, First Sgt., etc.) to insure someone will be there to meet him.
 - c. Obtains any work items noted by building custodian.
 - d. Considers skills and bench stock needed when identifying SMART work.
 - e. Records SMART minor maintenance and repair needs on AF Form 1219, original copy only (see figure 6-7). Completes all blocks down thru "signature of planning technician" block, EXCEPT the "incomplete Work" column and the "Total Actual Hours" block.
 - f. Records work that is "beyond the intent of SMART" on AF Form 1135 or 332.
6. Contacts work authorization specialist for a JO Number and the Collection Work Order Number.
7. Forwards 1219 to Chief of Programs.

**Chief of
Programs**

8. Signs 1219 in "Authorizing Signature" block. Sends to scheduler.

Scheduler

9. Includes the 1219s in the next weekly work schedule (see Chapter 12).
10. If estimated SMART manhours are less than manhours available in SMART cost center for the coming week, tells Chief of Work Control.

NOTE: SMART personnel authorizations may be increased by loans from other cost centers for short periods of time, as needed.

**Chief of
Work Control**

11. If told that estimated SMART manhours are less than available manhours, selects "Hoppered JOs or small Individual Work Orders in the same work area to use the rest of the hours.

Chief of
Work Control
(continued)

NOTE A: This action needs careful review since those jobs picked must be within SMART capability and supplies must be on hand.

NOTE B: When Individual Work Orders are used, make needed changes to BEAMS Work Order Record (WCN).

6-17. SMART: IF SUPPLIES RUN OUT OR WORK IS ADDED DURING WORK PROGRESS

Craftsman

1. If more supplies are needed and are not in bench stock, checks the "incomplete work" column on the 1219.
2. When doing SMART work, if the craftsman or building occupants identify extra work items, list them on the 1219.
3. If there is any question about doing the extra work, checks with the Chief of Work Control.

NOTE: Doing extra work items is practical and enhances the CE image. But, this added effort must be controlled. Give thought to supplies and manhour availability and take care not to disrupt the SMART schedule. Also, Service Calls can be done if they do not disrupt the SMART schedule very much.

6-18. SMART: ACTIONS UPON COMPLETION OF WORK

SMART Supervisor

1. When work is finished, including add-ons:
 - a. Enters total actual hours used and date completed, and signs AF Form 1219.
 - b. Tells controller the work is finished.
 - c. Sends 1219 to Chief of Work Control.

Chief of Work
Control

2. Reviews 1219 for items not completed:

IF →	THEN →
Not completed due to lack of supplies.	Decides to: <ol style="list-style-type: none"> a. Extract the item and prepare a Hopper JO, or b. Send to Program Development, or c. Defer until the next SMART visit.
Not completed due to other reasons.	Decides to: <ol style="list-style-type: none"> d. Create a Hopper or FAST JO, or e. Send to Program Development.

Chief of Work
Control
(continued)

3. Sends 1219 to work authorization specialist.

Work Authoriza-
tion Specialist

4. Files 1219 per local methods.

6-19. MILITARY FAMILY HOUSING RENOVATION -- ALL ACTIONS

Housing Manage-
ment Office

1. Keeps a current list of quarters due for occupant change.

Planner or
Housing
Inspector

2. Does a pre-final termination inspection per AFR 91-1.
3. Lists on AF Form 1219 the maintenance and repair work needed to renovate the set of quarters during occupancy change. (Normally done with bench stock).

NOTE A: Completes all blocks down thru "signature of planning technician" block, except the "incomplete work" column and the "total actual hours" block. See figure 6-7.

NOTE B: This work is limited to that needed to restore the quarters to a condition where it can be promptly reoccupied.

4. Lists on AF Form 1135 any extra work that will not be done during change of occupancy. Processes per Chapter 9.

5. Sends 1219 to work authorization specialist at once.

Work Authoriza-
tion Specialist

6. Assigns JO Number to 1219.

7. Gets signature of Chief of Programs or designee.

8. Sends to scheduler prior to scheduling meeting for the week the work is to be done.

Scheduler

9. Checks closely with the Housing Management Office to learn if the date of quarters termination changes before preparing the AF Form 561.

10. Lists each renovation JO on the back of the 561.

11. Sends the 1219 and the 561 to the cost center supervisor.

12. Reports to the controller any changes in the termination date after the 561 is prepared.
- Controller** 13. If advised of changes in termination date:
a. Tells the cost center supervisor.
b. Adjusts the daily schedule. Notes the change on the 561.
- Cost Center Supervisor** 14. Keeps controller advised on progress.
- Controller** 15. Reports labor on AF Form 1784 as work proceeds.
- Cost Center Supervisor** 16. When the work is finished:
a. Tells the controller so labor charges can be completed.
b. Shows on the 1219 any work not completed. Signs as complete. Sends to Chief of Work Control.
- Controller** 17. Completes all labor charges.
18. Tells Housing Management Office at once that the work is finished.
- Chief of Work Control** 19. Reviews 1219 for items not done:
- | IF ↓ | THEN → |
|--|--|
| Not completed due to lack of supplies. | Decides to:
a. Extract the item and prepare a Hopper JO, or
b. Send to Program Development, or
c. Defer until the next SMART visit. |
| Not completed due to other reasons. | Decides to:
d. Create a Hopper or FAST JO, or
e. Send to Program Development. |
20. Sends 1219 to work authorization specialist.
- Work Authorization Specialist** 21. Files 1219 per local methods.

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6-20

186		BASE SUPPLY		73 0717		PB-36	
FACILITY NO.		ACTIVITY OR STREET ADDRESS		DATE		CONTROL NO.	
NAME AND GRADE OF REQUESTOR		PHONE NO./ALTERNATE		TIME		WORK ORDER NO.	
N/A		5431/5432				00682	
SERVICE REQUIRED				TYPE OF SERVICE			
REPLACE STAINLESS STEEL SERVICE SINK - 22" X 18" COMBINATION FAUCET.				ZONE NO.		SV CALL	
						<input checked="" type="checkbox"/> IWP	
						FAST	
						HOPPER	
				ESTIMATED COMPLETION DATE		SELF HELP	
						SMART	
INDICATE WHEN WORK IS TO BE ACCOMPLISHED				CREW SIZE		EST TOTAL TIME	
				1		4.0	
AREA/FACILITY WHERE JOB IS LOCATED				REMARKS (Tools, equip, materials, special craftsmen multi shop notes, etc)			
SINK IN RM 126 - SEE SET JONES IN RM 102 FOR ENTRY				MATERIALS REQ'D			
DANGEROUS CONDITIONS EXIST (If any)				- STAINLESS SINK			
RESTRICTIONS (Time, entry, security)				- 22" X 18"			
				- (1445 clock)			
				- 3" TRAP			
				- (B/S)			
				- COMBINATION FAUCET			
				- (1445 clock)			
				- 8 FITTINGS			
				- (B/S)			
MAKE OF EQUIPMENT		TYPE/SIZE OF ITEM		COLOR OF ITEM			
ASSIGNED TO DATE		TIME COMPLETED BY		DATE		TIME INITIALS LUC 12 LUC	
REFERRED TO DATE		TIME COMPLETED BY		DATE		TIME INITIALS LUC 12 LUC	
DEFERRED TO DATE		TIME DISPOSITION		AUTHORIZED		Jana Yane	

AF FORM 1879 JAN 74 PREVIOUS EDITION WILL BE USED. SERVICE CALL/JOB ORDER RECORD

Figure 6-2. IWP Job Order

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6-21

[illegible]

AF FORM 1880
JAN 74

Figure 6-3. IWP Job Order Log

4130		BASE OPS		730710		1000		A0129	
FACILITY NO.		ACTIVITY OR STREET ADDRESS		DATE		TIME		CONTROL NO.	
NAME AND GRADE OF REQUESTOR		PHONE NO./ALTERNATE		DATE		TIME		WORK ORDER NO.	
Col GRUNTSO		5011/5020		5011/5020		00794		00794	
SERVICE REQUIRED		TYPE OF SERVICE		ZONE NO.		SV CALL		IMP	
CRASHED WINDOW IN BASE OPS DIRECTOR'S OFFICE.		8		X		FAST		SELF HELP	
SIDE APPROX. 24" x 30" - STEEL FRAME		ESTIMATED COMPLETION DATE		730713		HOPPER		SMART	
INDICATE WHEN WORK IS TO BE ACCOMPLISHED		CREW SIZE		1		EST TOTAL TIME		2.0	
AREA/FACILITY WHERE JOB IS LOCATED		REMARKS (Tools, equip, materials, special craftsmen - Utili shop notes, etc)		CUSTOMER WAS ASKED TO TYPE WINDOW.					
DANGEROUS CONDITIONS EXISTING (if any)		NO DANGER EXISTS							
RESTRICTIONS (time, entry, security)									
MAKE OF EQUIPMENT		TYPE/SIZE OF ITEM		COLOR OF ITEM					
ASSIGNED TO DATE	TIME	COMPLETED BY	DATE	TIME	INITIALS	LUC 12	LUC 16		
FAST #2 730713		Amr	0908 730713		Q.O.		1.5		
REFERRED TO DATE	TIME	COMPLETED BY	DATE	TIME	INITIALS	LUC 12	LUC		
DEFERRED TO DATE	TIME	DISPOSITION		AUTHORIZED	Mark Clark				

AF JAN 74 1879 PREVIOUS EDITION WILL BE USED. SERVICE CALL/JOB ORDER RECORD

Figure 6-4. FAST Processed Job Orders

63		SUB STATION #7		73 10 13	1100	B 23 16
FACILITY NO.		ACTIVITY OR STREET ADDRESS		DATE	TIME	CONTROL NO.
NAME AND GRADE OF REQUESTOR		PHONE NO./ALTERNATE		WORK ORDER NO.		
MR. FARANIGHT		5011/5020		01121		
SERVICE REQUIRED		DAMAGED FENCE AT SUB STATION #7. WIRE HEADS TO BE STRAIGHTENED AND NEW 7' POLE SET IN CONCRETE.		TYPE OF SERVICE		
				SV CALL		IMP
				FAST		SELF-HELP
				HOPPER		SVART
				ESTIMATED COMPLETION DATE		
				73 10 21		
INDICATE WHEN WORK IS TO BE ACCOMPLISHED				CREW SIZE	2	EST TOTAL TIME
				4.0		
AREA/FACILITY WHERE JOB IS LOCATED		REMARKS (Tools, equip, materials, special craftsman multi shop notes, etc)				
		LOOKS LIKE FENCE WAS HIT BY CAR				
DANGEROUS CONDITIONS EXISTING (if any)						
SAFE						
RESTRICTIONS (time, entry, security)						
MAKE OF EQUIPMENT		TYPE/SIZE OF ITEM		COLOR OF ITEM		
ASSIGNED TO	DATE	TIME	COMPLETED BY	DATE	TIME	INITIALS
						LUC 12
REFERRED TO	DATE	TIME	COMPLETED BY	DATE	TIME	INITIALS
451	73/016		Red White	73/020		LUC 16
DEFERRED TO	DATE	TIME	DISPOSITION	AUTHORIZED		
						4.8

SERVICE CALL/JOB ORDER RECORD

FORM AF JAN 74 1879 PREVIOUS EDITION WILL BE USED.

Figure 6-5. Hopper Processed Job Order

6-24

AF FORM 1880
JAN 74

Figure 6-6. Work Control Job Order Log

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Name of building custodian or designee, location, and phone nr.

Organization/Activity occupying the facility.

Collection Work Order Number for the facility.

Assigned Cost Center Code.

Name of planning technician and code.

Describe in enough detail to assure that the craftsman will know what is to be done. (What? Size? Quantity? Etc.)

Enter item, quantity and unit of measure.

Location of work within the facility. (Example: Room 26, Men's Latrine, South Hallway.)

Enter any comments relative to described work that may help craftsmen when doing the work.

STRUCTURAL MAINTENANCE AND REPAIR TIME JOB ORDER							
DATE	ORDER NO.	LOCATION	DESCRIPTION OF WORK	QUANTITY	UNIT	ESTIMATED COST	ACTUAL COST
4-97	00252	167 (Amu Bar)	167 (Amu Bar)	16	AUO	22	
Roberts P-1	92 445	7507 ELDER	7507 ELDER	2647	EL	48	
Pearl Sely	WALK STRAPS + STOPS	STOPS	STOPS	4	STOP	1	COP
RAR Wood Man BARK	NORTH END	NORTH END	NORTH END	14	Y ₂	COP	
RENNER LOOSE ENDS	NORTH END	"	"	Y ₄	COP		
Ba	for Stone	"	"	Y ₄	COP		
TOTAL EST. COST							
COMMENTS: EXT PAINT REQUIRED IN ROOM 23.-							
PROJECT # 23-16-3.							
DATE RECEIVED BY: [Signature]							
DATE RECEIVED BY: [Signature]							
DATE RECEIVED BY: [Signature]							

Figure 6-7. SMART Job Order, AF Form 1219.

APPENDIX B
CURRENT AFR 85-1 (EXTRACT)

	PARA.	PAGE
Section C—Optional Procedures for Job Orders		
General	6-12	6-4
Programming/Processing IWP Job Orders	6-13	6-5
Establishment of Job Orders Using FAST and Hopper		
Techniques	6-14	6-10
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Military Family Housing (MFH) Renovation	6-16	6-19

Chapter 6

JOB ORDERS

SECTION A—GENERAL—SYSTEM DESCRIPTION

6-1. Purpose of This Chapter. This chapter describes the Job Order system and work organization techniques used to authorize the accomplishment of work that generally does not require detailed planning. It provides an inexpensive means of processing work requirements from receipt to accomplishment.

6-2. Terms Explained:

a. Job Orders—A document used to authorize simple work that usually involves only one cost center and can be accomplished without detailed work planning and with a minimum of delay due to unavailable materials.

b. Job Order Number—The number assigned to a routine Job Order (IWP, SMART, or self-help) by the work authorization specialist. The number consists of two parts: the prefix is the Shop Code contained in AFM 67-1, vol II, part II, chapter 19; the second part begins with number 1 and is increased consecutively during the fiscal year. Examples of the Job Order Number are: PB-1, CA-13, LF-28, PB-34, and so forth.

NOTE: This Job Order Number is different from the Control Number assigned to service call, FAST and Hopper Job Orders by the Service Call specialist (see chapter 8 for explanation).

c. Structural Maintenance and Repair Team (SMART)—A team (separate cost center) composed of craftsmen of various skills performing routine minor maintenance and repair work on selected high use facilities (dormitories, dining halls, open messes, service clubs, and so forth) on a recurring basis. (See paragraph 1-10b(3)(b) for a further explanation of SMART.) Manpower authorizations for SMART will be reflected on Unit Detail Listings in Functional Account Codes for the various crafts, that is, Functional Account Codes 4451, 4452, and so forth. Authorizations within these Functional Account Codes for SMART will be identified with Organizational Structure Code MEMCG if the authori-

zations are associated with SMART on a permanent basis, that is, more than 180 days per year.

d. Fast Action Service Technique (FAST)—A technique of Job Order accomplishment utilizing a team(s) comprised of one or more craftsmen and one or more skills to accomplish, within 5 calendar days, small nonrecurring nonemergency, but urgent, work on base facilities and military family housing. (See paragraph 1-10b(3)(a) 1 for a further explanation of FAST.)

e. Hopper Technique—A scheduling technique which collects work requirements by area or system and collates the work into packages based upon craft and facility requirements.

f. Hopper Job Order—Direct scheduled Job Orders which are scheduled by the Hopper technique and which should be accomplished within the 30 day period following identification. See paragraph 1-10b(3)(a) 2 for a further explanation of this technique.

g. Military Family Housing (MFH) Renovation. A term used to define the maintenance and repair work accomplished in military family housing during a change in occupancy. This work is limited to that necessary to restore the quarters to a condition where it can be promptly reoccupied.

6-3. Concepts:

a. The Job Order system provides an economical means of authorizing and communicating work to craftsmen. This system allows grouping of job requirements and provides flexibility to accomplish jobs singly or in consolidated work packages. Supply support must be responsive by assuring that materials are on hand or are readily obtainable, for base civil engineering to realize maximum benefits from this system. Job Order requirements are satisfied using the following techniques of resource allocation:

(1) SMART Accomplishment. This method is only used to satisfy requirements in certain high use facilities, primarily to accomplish minor maintenance and repair tasks with a minimum of overhead and time lapse

between requirements identification and work accomplishment. Minor maintenance and repair tasks involve such things as replacing broken floor tile, touch-up painting, plumbing maintenance such as faucet washer replacement and flush valve repair, and repair of broken/inoperable electrical outlets. In other words typical "homeowner maintenance."

(a) The SMART cost center operates in the same manner as any other O&M cost center although it is usually trailer-based with the work crew reporting directly to the trailer. The SMART cost center could be comprised of one or more teams/trailers, depending upon the specific application of the concept at a particular location.

(b) The need for such a cost center will vary greatly. Each base has its own peculiar conditions which will be the basis for a requirement (or lack of a requirement) for a separate cost center to deal with minor maintenance and repair. Particularly variable are items such as the size of the base, number of operation and maintenance direct labor personnel authorized, condition of selected facilities, present success in minimizing overhead, and time lapse between requirements identification and accomplishment. If a SMART cost center is established, organization structure code (OSC) MEMCG will be used to reflect personnel assigned to the SMART cost center (457).

(c) Manning for SMART will be determined through consideration of, as a minimum, the variables mentioned in (b) above and must be carefully monitored to insure full use of personnel. Types of skill requirements may vary over a period of time. However, where historical data substantiates the requirement, action will be taken, through the local Management Engineering Team (MET), to include a position on the SMART UDI, for each man-year needed in a particular craft. This nucleus of authorized personnel may be augmented by loans from other cost centers for short periods of time as needed.

(d) The SMART cost center will accomplish only those minor work items which can be accomplished with available bench stock materials. SMART work is normally authorized by Job Order; however, an individual Work Order or Service Call should be accomplished when the team is in a particular facility if it does not interfere with or require extensive changes to the SMART schedule.

(e) The application of SMART for the correction of minor maintenance and repair needs in selected high use facilities can pro-

duce positive results. Conversely, this type of effort, if not effectively controlled and managed, can lead to a waste of resources. To this end, responsible managers must continually review the program to assure that the scope of requirements (facilities and work) and the available resources (material and labor) remain compatible. Limiting the operation strictly to high use facilities; preidentification of work requirements; availability of adequate bench stocks; and adherence to schedules are the keys to program success.

(2) Fast Action Service Technique (FAST). Jobs accomplished by FAST are those minor maintenance and repair requirements (normally of 2 man-hours or less) which are not emergencies and do not, therefore, qualify as Service Calls (see chapter 8) but which, for common sense reasons, should be accomplished within 5 days after identification. Materials to accomplish the FAST jobs must be readily available and craftsmen must have tools and equipment positioned on the FAST trucks or easily obtainable in the shops. Normally, only one craftsman per skill will be assigned to each truck. The FAST craftsmen may be either civilian or military, but must be versatile tradesmen able to handle a variety of jobs with minimal supervision. FAST job requirements may be generated as a result of customer telephone calls to the Service Call desk or from AF Form 1135, Real Property Maintenance Request. The requirements are usually collected by Work Control, grouped by task and area, and forwarded to the appropriate controller for assignment within 2 to 5 days. This work will be grouped geographically and by skill as much as possible.

(3) IWP accomplishment—This method is used when the accomplishment of the work requires materials that must be ordered, or when it does not have to be accomplished within 30 days.

(4) Hopper System—For those job orders which should be accomplished within 30 days but do not qualify for accomplishment by FAST or SMART, the "Hopper" system will be used. The idea is to use "Hoppers" designated for various areas of the base to accumulate work requirements, and on a recurring basis of less than 1 month, extract those requirements from a particular hopper, gather the materials required, decide on the skills required to do the various jobs, and schedule the work through the controller.

b. In order for the Job Order system to be effective, base civil engineering bench stocks must be adequate in terms of appropriate au-

thorized line items, and item availability. To this end, each foreman, material control specialist, and base civil engineering funds manager must apply concerted effort to assure the desired bench stock position. (See chapter 11.)

SECTION B—COMPLIANCE ITEMS

6-4. Job Orders:

a. AF Form 1879 Service Call/Job Order Record will be used to authorize:

- (1) IWP job orders.
- (2) Work to be accomplished through the FAST and Hopper techniques.

b. AF Form 1219 will be used to authorize SMART Job Orders and MFH renovation job orders.

6-5. Restrictions on the Use of Job Orders.

Job orders will NOT be used to authorize:

a. Any MFH minor construction (class MC) costing \$100 (total cost) or more, or construction on leased facilities (See chapters 7 and 9 and AFM 86-1.)

★b. Any base minor construction work costing more than \$500. MC work costing less than \$500 will not be authorized by job order if the work involved affects Real Property accountable records. The chief of programs will ensure that all proposed MC work by job order is coordinated with the real property function prior to issuing authorization for work.

NOTE: Care should be taken to ensure that if a MC job order that was originally planned to cost less than \$500 actually does exceed the \$500 restriction, a work order (AF Form 327) should be prepared to replace the job order. A review to determine if the real property records need to be capitalized should also be accomplished.

c. Any work accomplished by contract, except contract maintenance services for repair of motors, compressors, and so forth, (EEIC 569, funds).

①d. Any work or services performed for others chargeable to cost account code 61000, Reimbursable Work and Services.

e. Operations.

f. Services (except individual requests for entomology services which may be authorized by a job order).

g. Recurring maintenance as defined in chapter 5.

★h. Any work that requires capitalization in the Real Property Records as defined in AFM 93-1, (including the replacement of RPIE in a facility or the removal of RPIE from one fa-

cility for installation in another when the change requires capitalization).

i. Any work which requires materials which are not in one of the following categories:

- (1) On an authorized bench stock listing.
- (2) In the most current stock number directory unless a long lead time is indicated.
- (3) Obtainable through the standard supply system or COCESS within an acceptable period of time (generally 30-45 days for CONUS and 60-90 for overseas bases).
- (4) The Residual Material Holding Account (reference AFM 170-27).

6-6. Structural Maintenance and Repair Team (SMART):

a. Cost Center. Establish SMART as a separate work unit under the structures branch with cost center code 457, organization structure code MEMCG and shop code MO. The establishment of this separate work unit does not imply a need for a separate shop facility or other allocation of building space.

b. Manning. SMART will be composed of multicraft crew(s) under one supervisor. The supervisor will possess a seven level skill and should be in the 55XXX career field. The number of personnel required, by craft and skill level, will be based on the scope and condition of the facilities selected for maintenance under the SMART concept. Crew composition and size will be altered as necessary in response to varied requirements.

c. Equipment:

(1) Vehicle—Assign a vehicle to SMART from existing assets, when a need on a full time basis is fully justified. Otherwise, transportation will be provided on an as required basis.

(2) Trailer(s) will be obtained through a request to the base equipment management office and receipted for on a custodian account.

(3) Tools—Technical tool kits will be provided as authorized by TA 503. For portable tools and equipment requirements use TA 403.

★d. Materials. Establish a separate bench stock, using the assigned shop code (MO), to support all trailers. Physical location of the bench stock will be a base determination. Replenishment actions may be accomplished at the centralized bench stock location, at the trailers or at a point which is agreeable to both civil engineering and base supply. Of primary concern are ease of handling and maximum economy.

e. Facilities. Selection of facilities for maintenance under the SMART concept will be

limited to high use facilities (dormitories, BOQs, open messes, dining halls, service clubs, theaters, and so forth) and those facilities that have a history of frequent minor maintenance requirements due to age and construction. Military family housing WILL NOT be maintained by SMART.

f. AF Form 1219, SMART Job Order, will be used to authorize work.

g. SMART Facility Schedule and Inspection. After determining the facilities and frequencies, establish an annual schedule by week. Adherence to the schedule is mandatory. The facility schedule must be continually reviewed to alter frequency of maintenance and to delete or add facilities where such need is indicated. The planning function is responsible for conducting facility inspections and preparing AF Form 1219, SMART Job Order.

h. Labor Reporting. Time accounting for SMART will be performed by the controller.

6-7. Fast Action Service Technique (FAST):

a. FAST team(s) will be established to accomplish urgent (nonemergency) maintenance and repair work, generally of 2 man-hours or less, on MFH and base facilities.

b. A vehicle will be provided for each team.

c. Each FAST vehicle will be stocked with necessary materials, tools, and equipment to accomplish assigned jobs. Stock bins will be marked as to content and replenished from O&M cost centers bench stock as necessary. The appropriate shop will be responsible for obtaining necessary tools for craftsmen.

d. Labor time accounting for FAST mechanics will be performed by the controller.

6-8. Processing Job Orders (AF Form 1879 and AF Form 1219):

a. Fully completed job order forms will be used to authorize work to be accomplished by use of the job order system.

b. The chief of programs or designated representatives will authorize IWP, MFH renovation and SMART job orders. The chief of work control or his designated representatives will authorize all other job orders.

c. A system of numbering and controlling job orders will be established, using AF Form 1880, Job Order Log for IWP and SMART Job Orders. (See chapter 8 for numbering and control of other Job Orders).

d. Job orders derived from the IWP will be processed on a monthly basis for release to scheduling.

6-9. Other Requirements:

a. The AF Form 1879 will be reviewed prior to the weekly scheduling meeting to identify any additional materials that are required and not in Bench Stock.

b. Any job order requiring support from another cost center will be coordinated between the scheduler and appropriate superintendent to ensure all cost centers involved are provided a job order if required. The job orders will be cross referenced so controllers can schedule the work in proper sequence.

c. Job orders will be signed off as completed by the controller. On these job orders involving large resources or of a sensitive nature the foreman will initial in the "Initials" block on the controllers copy of the AF Form 1879 prior to the controller's sign off. The initials of the cost center foreman will also represent verification that excess/residue materials generated as a result of the job order action were processed in accordance with paragraph 11-13.

6-10. Job Order Requirements Received by Telephone.

Job orders generated by the service call specialist as a result of customer telephone calls, receipt of AF Form 1135, or other sources within O&M will be reviewed by the chief of work control and the following action taken. Review of the requirements for possible consolidation with other work on the current month work orders, scheduled SMART, Hopper or FAST work, current month IWP job orders, or other planned work. For those requirements which can be consolidated with existing work, identify the consolidation (for example, "Accomplish with Work Order 54321," "Accomplish with the SMART visit to Bldg. 626 on 10 October," "Refer to FAST" and so forth), and forward to the scheduler for inclusion on the applicable AF Form 561 and subsequent dispatch to the controller.

6-11. Cancellation. The following requirements are applicable:

a. Job orders may only be cancelled by the same level of authority, or higher, that approved the document upon which the job order was based.

b. Adequate procedures will be developed to assure accurate records and the proper notification of functions concerned with cancelled job orders.

c. Customers will be notified when job orders are cancelled as appropriate.

SECTION C—OPTIONAL PROCEDURES FOR PROCESSING JOB ORDERS

6-12. General. The job order is intended to serve as a simplified method of job requirement processing to reduce the administrative workload where detailed planning generally is not required and materials are normally available. It may be used for single shop or multishop jobs. (Multishop job orders must be limited to work that does not require close cost center interface.) The job order is intended primarily as a means of conveying instructions on job location and scope for work which does not require separate costing. The job order is planned to whatever extent necessary to convey sufficient instructions and to enhance efficient and economical accomplishment of jobs. (See chapter 15 for self-help job orders.) Job orders may be processed for accomplishment by the following two methods.

- a. Job orders processed through the IWP for accomplishment during a particular month.
- b. Job orders that do not qualify as emergency, (service calls) but which cannot wait for the normal IWP programming action.

6-13. Programming/Processing IWP Job Orders:

a. IWP job orders will be input from the following sources:

- (1) Requirements generated by AF Form 332.
- (2) Requirements generated through facility surveys.
- (3) Work requirements received through the service call system that are routine in nature and can wait for normal programming action.
- (4) Routine work generated within civil engineering.
- (5) Requirements generated outside civil engineering by submission of AF Form 1135, Real Property Maintenance Request.

b. Requirements for work generated by the sources identified in paragraph a above (excluding SMART surveys) will be reviewed by the chief of program development to determine if processing through the IWP job order programming avenue is the most feasible as opposed to IWP work orders or other work avenues. If so, it is forwarded to the IWP programmer for IWP job order processing.

(1) The IWP programmer will review each job requirement (to include the "S/80" card requirements) considering it for consolidation with other work. He will advise the work authorization specialist when to prepare the AF

Form 1879. In addition the IWP programmer will inform the work authorization specialist of which job requirement(s) is/are to be included on the AF Form(s) 1879.

(2) The AF Form 1879, Job Order, is designed so that two copies are accomplished simultaneously. The original is for the shop/craftsman and the duplicate copy is for the controller.

(3) Upon completion of the AF Form(s) 1879 (see figure 6-1) the work authorization specialist will assign a job order number and collection work order number to each job order. The work authorization specialist will log the job order on AF Form 1880 by completing column A; placing the current date in the appropriate type requirement column indicating whether the job order is direct scheduled, minor construction, or OTHER requirement; and completing columns E, G, and H (see figure 6-2).

(a) A separate AF Form 1880 will be maintained for each IWP month for each applicable O&M cost center or for all applicable cost centers depending upon the volume of IWP job orders.

(b) The IWP job order numbering will begin with number 1 prefixed by a shop code (for example PB-1) for each cost center during the fiscal year.

(4) The IWP job orders will then be forwarded to planning by the work authorization specialist.

c. The planning function will complete necessary planning and estimating data and identify required materials and availability. Using the bench stock listing, stock number directory and/or COCESS listing, they will prepare AF Form 1445, (in accordance with AFM 67-1, volume II, part two, chapter 19), if materials are not on hand, but obtainable through supply within an acceptable period of time. When the planner determines that additional cost centers are required, creating a need for "task force" multishop job orders, he will contact the work authorization specialist for assignment of job order numbers, initiate additional AF Forms 1879 as required, and cross reference each job order to others. Planning will then forward the job order, AF Forms 1445 and other supporting documents to the IWP programmer.

★(1) The IWP programmer will verify the IWP month of accomplishment and annotate the AF Form 1879 in the estimated completion block. He will then forward the job order(s) and other supporting documents (as appropriate) to the work authorization specialist. If the IWP month of accomplishment has changed from that previously determined (paragraph

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186		BASE SUPPLY		730717		PB-36	
FACILITY NO.		ACTIVITY OR STREET ADDRESS		DATE		CONTROL NO.	
NAME AND GRADE OF REQUESTOR		PHONE NO./ALTERNATE		TIME		WORK ORDER NO.	
N/A		5431/5432				00682	
SERVICE REQUIRED		ZONE NO.		TYPE OF SERVICE			
REPLACE STAINLESS STEEL SERVICE SINK - 22" X 18" COMBINATION FAUCET.				SV CALL		<input checked="" type="checkbox"/> IAP	
				FAST		<input type="checkbox"/> SELF HELP	
				HOPPER		<input type="checkbox"/> SMART	
				ESTIMATED COMPLETION DATE			
INDICATE WHEN WORK IS TO BE ACCOMPLISHED		CREW SIZE		EST TOTAL TIME			
		1		4.0			
AREA/FACILITY WHERE JOB IS LOCATED		REMARKS (Tools, equip, materials, special craftsmen multi shop notes, etc)					
SINK IN RM 126 - See Sgt Jones in Rm 102 for entry		MATERIALS REQ'D					
DANGEROUS CONDITIONS EXISTING (if any)		- SINGLE STL SINK					
RESTRICTIONS (time, entry, security)		- 22" X 18"					
MAKE OF EQUIPMENT		TYPE/SIZE OF ITEM		COLOR OF ITEM		- (1445 atch)	
ASSIGNED TO DATE		TIME COMPLETED BY		DATE		- 3" TRAP	
REFERRED TO DATE		TIME COMPLETED BY		DATE		- (B/S)	
DEFERRED TO DATE		TIME DISPOSITION		DATE		- COMBINATION FAUCET	
						- (1445 atch)	
						- 8 Fittings	
						- (B/S)	
AF FORM 1879 PREVIOUS EDITION WILL BE USED.		AUTHORIZED		DATE		SERVICE CALL/JOB ORDER RECORD	
		Jana Yane					

Figure 6-1. IWP Job Order.

6-13b(3) above) the work authorization specialist will update the AF Forms 1880 appropriately.

★d. The work authorization specialist will obtain the authorizing signature of the chief of programs or representative. He will enter estimated man-hours, by job order, in column F, and log the date received from planning in column I of AF Form 1880. If materials are required:

(1) After assigning the Required Delivery Date (RDD) and coordinating with the IWP programmer, the work authorization specialist will forward the job order and AF Form 1445 to material control for ordering the materials as outlined in chapter 11. He will annotate the AF Form 1880 in column J indicating the job order is in material control.

(2) Material control will notify the work authorization specialist when materials have been received by returning the job order and supporting documents.

(a) The work authorization specialist will indicate the date the job order is returned from material control by annotating column K, AF Form 1880.

(b) For those job orders for which materials are available or for which materials are not required, the work authorization specialist will group all job orders including multishop job orders, to be accomplished for the next month and send them to the chief of work control not later than 5 workdays before the end of the current month. The date that job orders are released to work control will be recorded in column L, AF Form 1880.

e. The IWP job orders will be reviewed at the weekly scheduling meetings by the foremen to assure that bench stock materials and qualified personnel are available. Additionally, any "Hopper" job orders that can be accomplished along with the IWP job orders (similar work by same craft and same building) will be grouped for scheduling action.

(1) If materials are not available, Material Control will be advised to request a bench stock fill, and then accomplish followup action to assure availability of materials.

(2) If all materials are available, the scheduler will list IWP Job Orders separately on the reverse side of AF Form 561.

f. Scheduled IWP Job Orders (duplicate copy) will be furnished to the controller with a copy of the AF Form 561. A copy of AF Form 561 and the original of the AF Form 1879 are furnished to the foreman. The work is then scheduled by the controller for accomplishment in accordance with chapter 12.

g. If during the course of the work, it is discovered that additional materials are required that are not in bench stock, the foreman will list the required supply items on his copy of the job order and forward to the controller. The controller will attach his copy of the job order and send to the chief of work control for decision to order materials and reschedule the job, or send the job order back to program development to obtain materials and reprogram in a subsequent IWP month. Program development will notify customer of any change or delay in the work schedule.

(1) If the chief of work control decides to order the materials, work control will send the job order to material control for requisitioning of the required items. Work control will maintain an AF Form 1880 to control these job orders by completing columns A through G and column J, AF Form 1880. (See figure 6-3) When materials become available, material control will send the job order back to work control. If man-hours are then available, annotate the date in column K on the AF Form 1880 and work control will send the job back through the normal scheduling procedure. If man-hours are not available, work control will annotate "to PD" and send the job order to program development for processing in a future IWP month. Material availability will be noted on the job order form if materials are in the holding area.

(2) If a long material lead time is indicated, the chief of work control will send the job order to program development for reprocessing in the IWP. AF Form 1880 will be annotated in column M to reflect this action.

★h. Upon completion of the job, the craftsman will notify the controller and report actual man-hours expended on AF Form 1879. The controller will enter the date completed in the "Date" block; enter the applicable LUC in the "LUC" block; record actual man-hours expended in lower portion of the "LUC" block; and sign ("Completed" block) his copy of the AF Form 1879 as complete. He will then transcribe the man-hour data onto the AF Form 1734 (see Chapter 12) and forward the AF Form 1879 to the work authorization specialist. If appropriate, the controller will obtain the foreman's initials in the "Initials" block prior to forwarding the AF Form 1879. (NOTE: the craftsman/shop can discard their copy of the AF Form 1879 after completion of the work.) The work authorization specialist will, on receipt of the completed AF Form 1879 from the controller, enter the current date in column M of the job order log (AF Form 1880)

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and forward the completed controller's copy to the IWP programmer. The IWP programmer

may file the job order in the facility folder if appropriate.

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AF FORM 1880 PREVIOUS EDITION WILL BE USED

Figure 6-3. Work Control Job Order Log.

i. When the requirement exists to use contract maintenance services (AFM 70-4; EEIC 569/533 Funds) for repair of motors, compressors, etc. (RPIE, and EAID if BCE responsibility) an IWP Job Order will be prepared by the work authorization specialist in coordination with the IWP programmer and Chief of O&M/Supintendent authorizing the removal, contract repair and reinstallation of the item. In addition to the Job Order, AF Form 9, a Purchase Request will be prepared for processing the item of equipment to the Contract Maintenance Activity (reference para 17-20 and AFM 70-4). The Collection Work Order Number assigned to the Job Order will also be entered on the Purchase Request to assure subsequent expensing of the costs involved to the appropriate Work Order/cost account. Work of this type will be processed and controlled as specified in the subparagraphs above for IWP Job Orders. Prior to initiating action for this category of contract maintenance service, the superintendent will verify that the item is not covered by warranty/guarantee (chapter 14).

6-14. Establishment of Job Orders Using FAST and Hopper Techniques. Job Orders generated as a result of telephone calls; AF Form 1135 (see figure 9-5) or, inputs made by base civil engineering personnel (foremen, craftsmen, and so forth, during normal course of work) will normally be processed using the Fast Action Service Technique (FAST) or by the Hopper technique of control and scheduling. FAST and Hopper processed Job Orders have one principle common characteristic; that being, they are always collected by area and reviewed for possible consolidation as a work package. Consideration is also given to the base civil engineering resources—manpower, material and vehicles, that will be necessary so that the best use may be made of what we have available. To establish FAST and Hopper techniques of tasking the work force, the following actions will be taken:

a. Determining the Work Zones:

(1) Select a representative sample from the Control Number Log (normally about 1 month's calls).

(2) Using a base layout map, plot the calls on the map by placing a colored dot near the facility for which the call was placed. This will give you the density of calls. In addition it may be useful to color code each call by craft to provide further work/resource data for subsequent management actions.

(3) Giving consideration to the dots, divide the base into 18 geographic work zones of an approximately equal density of calls. Number the work zones. Bases may, if they desire use some of their 18 work zone numbers for utility systems and other facilities which might cover more than one geographic zone. When this is done the number of zones on the base map will be reduced accordingly. (For example, if numbers are used for the electrical distribution system, and the heating distribution system there would be 16 left to divide the dots.)

(4) Identify the zone number by each facility on the Service Call specialist's copy of the BCE Collection Work Order Number Listing (PCN N200367). Regardless of the number of zones established, it is intended that work in each zone be scheduled once a month for Hopper work.

(5) Work zones may require adjustments depending upon the workload. This will become noticable by the volume of Job Orders being collected for different zones. A yearly review and update of the designated zone areas should be conducted to ensure that the Job Order work load distribution is compatible with existing zones. Different zone designations may be required if workload distribution has changed significantly.

b. The Hopper—A Hopper for each work zone will be established for collecting and consolidating work requirements. The Hopper will be subdivided into two sections, a small section for FAST accomplishment and a larger one for routine work. Bases may use any method they desire to develop their Hoppers such as tub files or cabinets; the recommended method is shown in figure 6-4. Locations of the hopper should be near or adjacent to the Service Call room and Chief of Work Control office.

c. "FAST" Processing. Minor maintenance and repair work received by the Service Call specialist that does not qualify as an emergency (chapter 8) but which requires prompt attention will be entered on AF Form 1879 (see figure 6-5) and identified for FAST accomplishment including reference to zone number. Following preparation, these Job Orders are forwarded to the Chief of Work Control who will:

(1) Review the requirement to assure:

(a) The need to accomplish as a FAST Job Order. (Only those urgent requirements that must be done within 2 to 5 days should be coded FAST). If it is not necessary to ac-

comply by FAST, the Chief of Work Control will identify the proper processing technique and process the Job Order accordingly.

(b) The necessary skills are available.

(c) The necessary materials are available. If materials are not available, Material Control will be advised to request a bench stock fill, and then accomplish follow-up action to assure availability of materials. If during the course of the work it is discovered that additional materials are required that are not in bench stock, the procedures outlined in paragraph 6-13g above will be followed.

(2) Place his best estimate as to the crew size and actual man-hours required in the "Crew Size" and "Est Total Time" blocks, on the AF Form 1879, assign the LUC, and sign name in authorized block.

(3) Determine if there is any currently scheduled work being accomplished in the facility within the next 5 working days. If so the Chief of Work Control will forward the AF Form 1879 through the scheduler to the applicable controller with instructions to schedule the Job Order with the previously scheduled work.

(4) Place the Job Orders passing the tests specified in (1) above in the Hoppers in accordance with the work zone applicable to the facility specified on the Job Order.

(5) Ensure that the Service Call specialist is informed of the final disposition of the Job Order so that he can verify that the requester was notified of the proper work schedule. In the event the final disposition of the Job Order differs from what the requester was told originally—the Service Call specialist will inform the requester of the change.

(6) At the beginning of each work day the Chief of Work Control or his designee will:

(a) Extract one horizontal row of FAST Job Orders from the Hoppers (six zones) and arrange them by the skills required.

(b) Consolidate the FAST Job Orders into work packages. Work packages are one or more Job Orders applicable to the same Collection Work Order Number and/or facility, that can be considered as a single job. Work assignment and content is then by the job (for example, FAST work in bldg 306) instead of each of the Job Orders. Since two copies of each AF Form 1879 are in the FAST hoppers there should be two sets of the work package.

1. Controllers set. The set which the controller uses to record and maintain status of job assignments on the AF Form 1734. He

also uses the set to record the actual manhours and completion date upon receipt of the craftsmans telephone call notifying the controller of job completion. This set becomes the Job Order record.

2. Cost Center's set. This set is used for information purposes by the foreman/FAST team leaders to identify any out of the ordinary personnel requirements, material requirements and special tools that will be required to accomplish the FAST Job Orders. When the work is such that the AF Form 1879 is needed for clarity it also provides the craftsman with an adequate description of the work to be accomplished. Upon completion of the work, copies of the Job Orders in this set can be discarded.

(c) Forward the shop set of work packages to the applicable foreman or FAST team leader so that material and special tool requirements that will be placed upon his shop/team the next day will be pre-identified and all necessary preparation can be completed.

(d) Forward the second set of work packages to the controller for assignments on the Daily Work Schedule in accordance with chapter 12. The foreman and the controller will coordinate the FAST assignments for the next duty day prior to the end of the workday.

(e) The scheduler should be alert for backlogging of FAST jobs by the controller and must insure that additional work is not added to further aggravate this situation. He should contact the Chief of Work Control for resolution, such as rerouting work to other avenues of accomplishment.

(f) Upon job completion the controller will be notified by the craftsmen. The controller will record the applicable manhour data and sign the Job Order as completed. He will then furnish the completed Job Orders to the scheduler. The scheduler, will forward the completed FAST Job Orders to the Service Call specialist. See chapter 8 for disposition.

d. Hopper Processing. This technique is used by base civil engineering to process those minor maintenance and repair requirements that can be accomplished through consolidation of work requirements. It attempts to save job preparation, labor time, travel, and certain other administrative time by accomplishing, on a fixed schedule basis, previously identified and consolidated work within predetermined work zones. The following are the steps taken in processing a Job Order using the Hopper technique:

(1) Upon receipt, from the Service Call specialist, of those Job Orders tentatively

HOPPER & FAST ZONES

NOVEMBER 1972						
SUN	MON	TUE	WED	THU	FRI	SAT
			1	2	3	4
				1	2	3
5	6	7	8	9	10	11
				5	6	7
12	13	14	15	16	17	18
				9	10	11
19	20	21	22	23	24	25
				14	15	16
26	27	28	29	30		
				18		

OCTOBER 1972						
SUN	MON	TUE	WED	THU	FRI	SAT
1	2	3	4	5	6	7
			1	2	3	4
8	9	10	11	12	13	14
				6	7	8
15	16	17	18	19	20	21
				10	11	12
22	23	24	25	26	27	28
				15	16	17
29	30	31				
				18		

HOPPER-ZONE = WORK DAY
FAST - 6 ZONES = WORK DAY

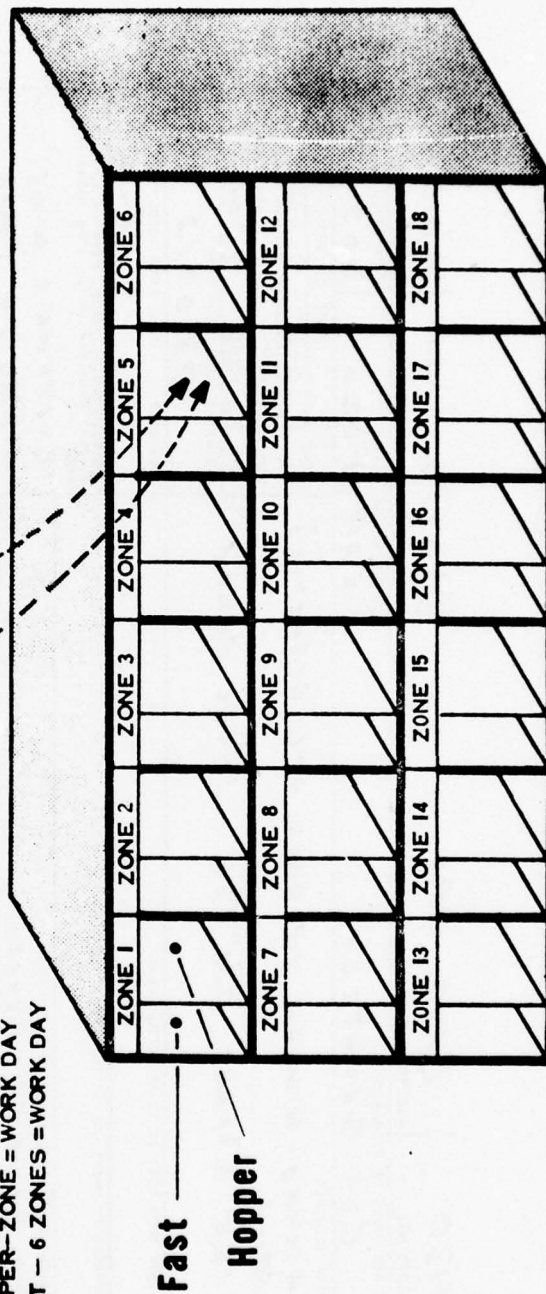


Figure 6-4. Hopper and FAST Zones.

4130	BASE OPS	730710	1000	A0129
FACILITY NO.		DATE	TIME	CONTROL NO.
NAME AND GRADE OF REQUESTOR		PHONE NO./ALTERNATE	WORK ORDER NO.	
Col GRUNTS		5011/5020	00794	
SERVICE REQUIRED				
CRASH WINDOW IN BASE OPS DIRECTOR'S OFFICE.				
SIDE APPRX. 24" x 30" - STEEL FRAME				
INDICATE WHEN WORK IS TO BE ACCOMPLISHED				
AREA/FACILITY WHERE JOB IS LOCATED				
DANGEROUS CONDITIONS EXISTING (if any)				
NO DANGER EXISTS				
RESTRICTIONS (time, entry, security)				
MAKE OF EQUIPMENT		TYPE/SIZE OF ITEM		COLOR OF ITEM
ASSIGNED TO DATE	TIME	COMPLETED BY	DATE	INITIALS LUC 12
FAST 42	730713	ONE	ONE	Q.O.
REFERRED TO DATE	TIME	COMPLETED BY	DATE	INITIALS LUC 12
DEFERRED TO DATE	TIME	DISPOSITION	AUTHORIZED	
		Mark Clark		
FORM AF JAN 74 1879 PREVIOUS EDITION WILL BE USED.				
SERVICE CALL/JOB ORDER RECORD				

Figure 6-5. FAST Processed Job Order.

identified for taking using the Hopper technique (see figure 6-6), the Chief of Work Control will:

- (a) Review the requirement to assure:
 1. The need to accomplish as a Hopper Job Order (that is within 30 days).
 2. The necessary skills are available.
 3. The necessary materials are available. Follow the procedures in paragraph 6-13g and 6-14c(1) (c) as appropriate.

(b) If the requirement fails any of the tests specified in (a) 1 through 3 above, identify the proper processing technique (IWP Job Order, Work Order, project, and so forth) and process the requirement accordingly.

(c) Review the requirement to determine if there is any currently scheduled work being accomplished in the facility by applicable shops or SMART on a scheduled Work Order or Job Order and assign the LUC. If so, the Chief of Work Control will forward the AF Form 1879 through the scheduler to the applicable controller with instructions to schedule the Hopper Job Order with the previously scheduled work.

(d) Place the Job Orders passing the tests specified in (a) 1 through 3 above in the Hoppers in accordance with the work zone applicable to the facility specified on the Job Order.

(e) Ensure that the Service Call specialist is informed of the final disposition of the Job Order so that he can verify that the requester was notified of the proper work schedule. In the event the final disposition of the Job Order differs from what the requester was told originally—the Service Call specialist will inform the requester of the change.

(2) Prior to the weekly scheduling meeting Work Control will extract the Job Orders from the appropriate hoppers and arrange by skills required. Following this action, each concerned foreman will:

(a) Review the Job Orders that will be scheduled during the Weekly Schedule Meeting to determine:

1. If a particular craftsman should be assigned to the job. If so, the foreman will annotate the AF Form 1879 with "AS-SIGN to (craftsman's name)". This procedure will be followed only when absolutely necessary, otherwise controller flexibility is lost.

2. The availability of the required materials. If the materials are not locally available in bench stock or base supply he will annotate that fact, and list the required materials (if they are not so indicated), estimate

the man-hours required and return the AF Form 1879 to the Chief of Work Control who will make the decision to either order the required materials and reschedule the Job Order after receipt, or process to Program Development for inclusion in the IWP. In the latter case, the customer will be notified as appropriate.

(b) Place his best estimate of the crew size and the estimated total time on the AF Form 1879.

(3) Following the review/actions by the foremen in paragraph (2) above, the Chief of Work Control will sign the AF Form 1879 in the "Authorizing Signature" block and forward these "work packages" to the scheduler.

(4) The scheduler will:

(a) Add the estimated man-hours for each shop and enter the total man-hours for Hopper requirements as one line item on Part Two of the BCE Weekly Work Schedule.

(b) Schedule Job Orders (including Hopper) in accordance with chapter 12. If the Hopper Job Order hours are sufficient, a team supervised by a working leader from the lead shop will be established. When the team is established, the craftsmen remain assigned to their respective cost center. Consideration should also be given to assigning a trailer, stocked with materials, to the team. This trailer would then be moved from zone to zone as the team moves.

(5) Upon job completion, the controller will forward the completed "Hopper" Job Orders to:

(a) The Service Call specialist for those jobs generated through the Service Call Section. See chapter 8 for disposition.

(b) The work authorization specialists for those jobs originated in Program Development. He will update the AF Form 1880 and forward the AF Form 1879 to the IWP programmer.

(c) The IWP programmer will screen the completed Job Orders. Those which he considers of significant historical interest will be filed in the facility folder. All others will be discarded.

6-15. SMART Job Orders. The following procedures are applicable when a SMART cost center has been authorized and established:

a. SMART work requirements are identified by planning technician(s) according to a predetermined facility survey schedule. This schedule is developed for high-use facilities and approved by the Chief of Programs. Copies of the approved schedule are distributed to the

63		SUB STATION #7		73 10 13	1100	B 2316
FACILITY NO.		ACTIVITY OR STREET ADDRESS		DATE	TIME	CONTROL NO.
NAME AND GRADE OF REQUESTOR		PHONE NO./ALTERNATE		WORK ORDER NO.		
MR. FARANIGHT		5011/5020		01121		
SERVICE REQUIRED		TYPE OF SERVICE				
DAMAGED FENCE AT SUB STATION #7. WIRE HEADS TO BE STRAIGHTENED AND NEW 7' POLE SET IN CONCRETE.		ZONE NO.	SV CALL	IWP		
		14	FAST	SELF HELP		
			HOPPER	SMART		
		ESTIMATED COMPLETION DATE				
INDICATE WHEN WORK IS TO BE ACCOMPLISHED		CREW SIZE		EST TOTAL TIME		
		2		4.0		
AREA/FACILITY WHERE JOB IS LOCATED		REMARKS (Tools, equip, materials, special craftsmen multi shop notes, etc)				
		Storm damage. Wind blew tree limb into fence.				
DANGEROUS CONDITIONS EXISTING (if any)						
SAFE						
RESTRICTIONS (time, entry, security)						
MAKE OF EQUIPMENT		TYPE/SIZE OF ITEM		COLOR OF ITEM		
ASSIGNED TO	DATE	TIME	COMPLETED BY	DATE	TIME	INITIALS
REFERRED TO	DATE	TIME	COMPLETED BY	DATE	TIME	INITIALS
451	731016		Red White	731020		RLA
DEFERRED TO	DATE	TIME	DISPOSITION	AUTHORIZED		
FORM 1879 PREVIOUS EDITION WILL BE USED.		SERVICE CALL/JOB ORDER RECORD				

Figure 6-6. Hopper Processed Job Order.

chief of work control, scheduler, and service call specialist. The planning inspectors must complete SMART facility inspections for work to be accomplished in the forthcoming week prior to the current weekly scheduling meeting. Each facility folder and facility number file for the facilities to be inspected will be reviewed for requirements prior to inspection. The planning technician will contact the building occupant (building custodian, first sergeant, and so forth) prior to his arrival to let him know he is coming and to ensure someone will be there to meet him. When he arrives he will obtain any work requirements the building custodian has identified. During inspection of the facility, the planning technician will consider the skills and bench stock availability when identifying SMART requirements. Any work identified that is beyond the intent of SMART will be recorded and accomplished by another method (for example, HOPPER, IWP job order, IWP work order, and so forth). AF Form 1219, SMART Job Order, will be used by the planning technician to record the minor maintenance and repair requirements to be accomplished.

b. Preparation of AF Form 1219. SMART Job Order. AF Form 1219 is prepared in an original copy only. (See figure 6-7.) The planning technician will complete the following blocks:

(1) Cost Center—Enter assigned cost center code.

(2) Work Order Number—Enter the applicable collection work order number for the facility. (See paragraph c below.)

(3) Facility Number—Self-explanatory.

(4) Date Prepared—Self-explanatory.

(5) Planning Technician and PT Code—Name of planning technician and code.

(6) Using Agency—Organization/activity occupying facility.

(7) Individual to Contact—Name of building custodian or designee, location and phone number.

(8) Work Description—Describe work in sufficient detail to assure that the craftsmen will know what is to be done (What?, Size?, Quantity?, and so forth).

(9) Location—Define the location of the work within the facility. (Ex-Room 26, Men's latrine, South Hallway)

(10) Materials—Enter item, quantity, and unit of measure of required materials. (Ex-Duplex outlet, Brown, 4 each).

(11) Man-hour Estimate—Enter man-hour estimate for each work requirement.

(12) Craft—Enter name of craft required

to accomplish the work ("ELEC", "PLUMB", "CARP", and so forth).

(13) Total Estimated Man-hours—Enter estimated man-hours by craft and total.

(14) Planning Technician Signature—Self-Explanatory.

(15) Remarks—enter any comments relative to the described work that may assist craftsmen during accomplishment.

c. The work authorization specialist will be contacted for; assignment of a job order number; logging the requirement on the job order log; and the applicable collection work order number to the AF Form 1219. He will obtain the authorizing signature of the chief of programs or designated representative. It is then forwarded to the scheduler for inclusion in the forthcoming weekly work schedule (See chapter 12.) When estimated man-hours on the SMART job orders, planned for accomplishment in the coming week, fall short of the man-hours available in the SMART cost center, the chief of work control will select "hoppered job orders" or small individual work orders within the same working area to eliminate the man-hour deficit. This action requires careful review as those jobs selected must be within SMART capability and materials must be available. Where individual work orders are selected, appropriate changes to BEAMS work order shop records (WCN) will be necessary.

d. During work accomplishment and when the described work item cannot be accomplished due to lack of materials, the SMART craftsmen will check the "Incomplete Work" column on the AF Form 1219. If the required item is on bench stock, an "out of cycle" replenishment should be requested or an attempt made to obtain the item from another cost center's bench stock.

e. Experience has shown that during the course of SMART work accomplishment within a facility, occupants will identify certain work needs that are not included on the job order as they were not found by the planner during his inspection. Likewise, the assigned craftsmen usually identify additional work items. While the intent of SMART is to correct those minor maintenance and repair deficiencies listed on the job order, the accomplishment of additional work items is certainly practical and tends to enhance the civil engineering image. However, this added effort must be controlled. Primary considerations for doing any additional work are material and man-hour availability; care must be taken not to impair the SMART schedule. Craftsmen will list all additional work requirements on the AF Form 1219. If there

STRUCTURAL MAINTENANCE AND REPAIR TEAM JOB ORDER					JOB ORDER NO.		
COST CENTER		WORK ORDER NO.	FACILITY NO.	DATE PREPARED			
PLANNING TECH & PT CODE		USING AGENCY	INDIVIDUAL TO CONTACT (Name & Phone No.)				
457		00252	168 (Ann Darr)	16 Aug 72			
ROBERTS P-1		92 FMS	TSGT ELDER 7649/7648				
WORK DESCRIPTION	LOCATION	MATERIALS			M/HR EST.	CRAFT	INCOM- PLETE WORK
		ITEM	QNTY	U/M			
REPL SFTY WALK STRIPS	NORTH AREA + STAIRS	6" X 24" SFTY WALK STRIP	4	EA	1	CARP	
RRR Wood Top Rack	NORTH EXIT	NAILS PD	14		1/2	CARP	
REPAIR LOOSE EAVE	NORTH EAVE	"			1/4	CARP	
REPL TORN SCREEN-WINDOW	1ST FLOOR LATRINE	30" X 40" WIRE MESH			1/2	CARP	
ADJUST DOOR CLOSER	SO. EXIT				1/4	CARP	
REPAINT DOOR + TRIM (MATCH EXISTING COLOR)	FRONT ENTR EXIT ONLY	ENAMEL (LT. GRN)	1	QT	1/2	PAINT	
PATCH RANDOM CRACKS WALLS - (APPROX 50 LF)	1ST FLOOR SO. WALL ABOVE TILE	PLASTER	1	LB	3	PAINT	
PAINT AREA (INTERIOR)	"	ENAMEL (WHITE)	1	QT	2	PAINT	
REPL 8 Floor Tiles	2ND FLOOR HALLWAY - North end	TILE - GRN. MGR	8	EA	1	CARP	
RRR 2 - T-Paper Hangers	2ND FLOOR LATRINE				1/2	CARP	
RPL WASHERS-LATRINES	2ND FLOOR LATRINE	WASHER SET	3	EA	1/4	PAINT	

AF FORM 1219 JUL 72

Figure 6-7. SMART Job Order.

WORK DESCRIPTION	LOCATION	MATERIALS			M/HR EST.	CRAFT	INCOM- PLETE WORK	
		ITEM	QNTY	U/M				
Repl 4 Shower Heads	2nd Flr Lot	SHWR Head	4	ea	1/4	Plumb		
Repl Switch Plates	Rms 104 120, 201, 207 + 209	Wall Switch Plate (white)	5	ea	3/4	Elec	X	
Repl Outlet	2nd Floor Lounge	duplex outlet (tan)	1	ea	1/2	Elec		
Repl EXT LIGHT	West EXT	lamp holder	1	ea	1	Elec		
Repl PWR Outlet for Dryer	2nd Floor WASH RM	220V, 30A 3-wire	1	ea	1 1/4	Elec		
Repl ext. Shingles	Ext	1'X2'	6	ea	1	Carp		
		asph/shing				RCM		
TOTAL ESTIMATED MAN HOURS		CARP.	PLUMB.	ELEC.	PAINT.	OTHER	TOTAL	TOTAL ACT. HRS.
		4	2	3 1/2	5 1/2		15	18
REMARKS								
COMPLETE EXT PAINT SCHEDULED IN MAR 73.-								
Protect PB-16-3.								
SIGNATURE OF PLANNING TECHNICIAN								
John Roberts								
DATE ORDERED				AUTHORIZING SIGNATURE				
27 Aug 72				Howard Craft				
DATE COMPLETED				SUPERVISOR'S SIGNATURE				
23 Aug 72				Paul Goodman				

Figure 6-7. Continued.

is any question as to whether to do work, the chief of work control will be consulted.

f. Upon completion of the work requirements, including add-ons, the SMART Supervisor will enter the total actual hours expended, date completed and signature, in the appropriate blocks of AF Form 1219. The concerned controller is advised of the work completion and AF Form 1219 is then forwarded to the chief of work control.

★g. The chief of work control will review completed AF Forms 1219 taking particular note of incompleting work items due to lack of materials. In such cases, he will make the decision to extract the item and prepare a job order for later accomplishment (Hopper), send to program development for their action, or defer until the next scheduled SMART visit. Following this review or action, AF Form 1219 is sent to the work authorization specialist and placed in the facility folder. For those items that cannot be accomplished due to reasons other than materials, the chief of work control will create Hopper or FAST job orders or refer to program development as appropriate.

6-16. Military Family Housing (MFH) Renovation. MFH renovation work as defined in paragraph 6-2g will be authorized by AF Form 1219. The following steps will be followed in processing work by this method:

a. The Housing Management Office will maintain a current list of quarters due for occupant change. A planning technician, or housing inspector, will perform a prefinal termination inspection in accordance with AFR 91-1. Maintenance and repair work necessary to renovate the set of quarters during occupancy change will be listed on AF Form 1219. Any additional work, such as other maintenance or repair work that will not be performed during change of occupancy, will be listed on AF Form 1135 and processed as outlined in chapter 9. Bench stock materials will normally be used in accomplishing MFH renovation work.

b. The AF Form 1219 will be prepared in the same manner as outlined for SMART work in paragraph 6-15b. The properly completed AF Form 1219 will be furnished to the work authorization specialist as soon as it is prepared.

c. The work authorization specialist will assign a job order number to the AF Form 1219 and obtain authorization signature of the chief of programs or his designated representative.

d. The AF Form 1219 will be forwarded by the work authorization specialist to the scheduler prior to the scheduling meeting for the week the house is to be renovated.

e. The scheduler will list each renovation job order on the reverse side of AF Form 561 in the same manner as IWP and SMART job orders. Close coordination is required between the housing management office and scheduler if the date of quarters termination changes before the AF Form 561 is prepared.

f. The AF Form 1219 is furnished to the responsible cost center supervisor with his copy of the AF Form 561. The controller will maintain close contact with the cost center supervisor and report the labor on AF Form 1734 as the renovation work is accomplished. Any changes in the termination date occurring after preparation of AF Form 561 will be reported to the controller who will advise the cost center supervisor and adjust the daily schedule, noting the deviation on the AF Form 561.

g. When the renovation work is completed, the cost center supervisor will sign the AF Form 1219 complete and notify the controller so all labor charges can be completed. The controller will immediately notify the Housing Management office that the renovation work is completed and the house is ready for assignment to a new occupant. The AF Form 1219 will be annotated by the supervisor of the responsible cost center to indicate any work not accomplished. The completed AF Form 1219 is then forwarded to the chief of work control for processing in the same manner as outlined for SMART in paragraph 6-15g.

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APPENDIX C
JOB KNOWLEDGE TEST INSTRUMENT

Written Communications Experiment

Multiple Choice Questions

Part I

1. The AF Form 1879 for an IWP Job Order is prepared by:

- a. The IWP programmer.
- b. The work authorization specialist.
- c. The planner.
- d. Is not prepared for IWP Job Order.

Ans. B Page nr. 6-5, cur. (current AFR 85-1) ; 6-9, exp.
(experimental AFR 85-1)

2. When a FAST Job Order is completed, who is supposed to sign it as completed?

- a. The craftsman.
- b. The controller.
- c. The foreman.
- d. The scheduler.

Ans. B Page nr. 6-11, cur.; 6-15, exp.

3. The controller is notified of changes in termination dates for MFH renovation when:

- a. Changes occur after the AF Form 561 is prepared.
- b. Only after the scheduler has been notified.
- c. Changes occur before the AF Form 561 is prepared.
- d. At least 6 weeks in advance.

Ans. A Page nr. 6-19, cur.; 6-19, exp.

4. MFH maintenance and repair work that will not be done during the change of occupancy is:

- a. Listed on AF Form 1219.
- b. Not documented during the prefinal termination inspection.
- c. Listed on AF Form 332 by the planning technician or housing inspector.
- d. Listed on AF Form 1135.

Ans. D Page nr. 6-19, cur.; 6-18, exp.

5. After preparing AF Form 1879 for an IWP Job Order the work authorization specialist:

- a. Assigns a Job Order Number and Collection Work Order Number to each Job Order.
- b. Logs the Job Order on AF Form 1219.
- c. Sends to IWP programmer.
- d. Checks to see if other work is scheduled.

Ans. A Page nr. 6-5, cur.; 6-9, exp.

6. Upon completion of SMART work the SMART Supervisor will:

- a. Enter the total actual hours used, the date completed, and his signature on AF Form 1219.
- b. Advise scheduler of the work completion.
- c. Forward the 1219 to the Chief of Programs.
- d. All of the above.

Ans. A Page nr. 6-19, cur.; 6-17, exp.

7. For housing renovation Job Orders the scheduler _____ the Job Orders on the reverse of the AF Form 561, Weekly Work Schedule.

- a. Groups.
- b. Lists each of.
- c. Fully describes.
- d. Does not enter.

Ans. B Page nr. 6-19, cur.; 6-18, exp.

8. If the estimated manhours on SMART Job Orders for the coming week are less than the SMART manhours available, the Chief of Work Control should:

- a. Advise the SMART team to work slower.
- b. Select Hoppered Job Orders or small individual Work Orders to fill out the schedule.
- c. Instruct the SMART planner to reinspect the facility to identify additional work.
- d. Schedule housing renovation Job Orders to fill out the schedule.

Ans. B Page nr. 6-16, cur.; 6-16, exp.

9. When an IWP Job Order is finished, which of the following may discard their AF Forms 1879?

- a. Controller.
- b. Scheduler.
- c. Craftsman/shop.
- d. IWP programmer.

Ans. C or D Page nr. 6-8 or 6-8.1, cur.; 6-15, exp.

10. At weekly scheduling meetings IWP Job Orders are reviewed to assure that bench stock and qualified craftsmen are available. Who does this?

- a. Planner.
- b. IWP programmer.
- c. Foreman.
- d. Chief of Work Control.

Ans. C Page nr. 6-8, cur.; 6-11, exp.

11. During work on an IWP Job Order it was found that extra supplies were needed. They were not in bench stock so the Job Order was sent to Material Control to get the items. When they come in, Material Control sends the Job Order back to:

- a. The planner.
- b. Work Control.
- c. Program Development.
- d. Work authorization specialist.

Ans. B Page nr. 6-8, cur.; 6-14, exp.

12. When the foreman receives Hopper Job Orders to review prior to the Weekly Scheduling Meeting, he:

- a. Arranges the jobs by skills required.
- b. Enters the estimated man-hours for each shop on Part Two of the Weekly Work Schedule.
- c. Signs the Job Orders in the "Authorized" block.
- d. Enters his estimate of man-hours and crew size on the Job Order.

Ans. D Page nr. 6-14, cur.; 6-13, exp.

13. Upon completion of a FAST Job Order the controller is notified by the craftsman. The controller then:

- a. Records man-hour data.
- b. Signs the Job Order as complete.
- c. Sends the completed Job Order to the scheduler.
- d. All of the above.

Ans. D Page nr. 6-11, cur.; 6-15, exp.

14. A Job Order should be coded as FAST if it must be done within:

- a. 48 hours.
- b. 5 days.
- c. 30 days.
- d. 6 months.

Ans. B Page nr. 6-10, cur.; 6-12, exp.

15. Prior to initiating IWP Job Order action for contract maintenance service on a compressor the superintendent will:

- a. Verify that the item is not covered by a guarantee/warranty.
- b. Insure the needed parts are available.
- c. Check with the controller to insure adequate time is available in the following month's schedule.
- d. Determine how many copies of the Job Order will be needed.

Ans. A Page nr. 6-10, cur.; 6-9, exp.

16. When reviewing a FAST Job Order, if the Chief of Work Control finds there is other work scheduled within 5 days in the same facility he should:

- a. Cancel the other work.
- b. Have the FAST call added to the other work.
- c. Change the FAST call to Hopper.
- d. Have the customer submit an AF Form 1135.

Ans. B Page nr. 6-11, cur.; 6-12, exp.

17. The scheduler should watch for backlogging of FAST jobs by the controller and insure that:

- a. No additional work is added to further aggravate this situation.
- b. Additional help is provided to the controller.
- c. The controllers poor performance is reported to the superintendent.
- d. New FAST jobs are included in the backlog.

Ans. A Page nr. 6-11, cur.; 6-13, exp.

18. The Planning Function completes planning and estimating data for IWP Job Orders and identifies needed supplies and availability. If supplies are not on hand but can be obtained through supply within 30 to 45 days the planner:

- a. Prepares AF Form 1445.
- b. Returns the IWP Job Order to the work authorization specialist.
- c. Sends the IWP Job Order to the IWP programmer for cancellation.
- d. None of the above.

Ans. A Page nr. 6-5, cur.; 6-10, exp.

19. When scheduling an IWP Job Order the Foreman should:

- a. Check with the superintendents to insure all appropriate cost centers are involved.
- b. Send the Job Order to work control.
- c. Make sure that bench stock and qualified craftsmen are available.
- d. List the Job Order on the back of the AF Form 561.

Ans. C Page nr. 6-8, cur.; 6-11, exp.

20. A Military Family Housing Job Order Number is assigned to the AF Form 1219 by:

- a. The Work Authorization Specialist.
- b. The Scheduler.
- c. The Planner.
- d. The Housing Management Office.

Ans. A Page nr. 6-19, cur.; 6-18, exp.

Written Communications Experiment

Multiple Choice Questions

Part II

1. IWP Job Order numbering begins with 1 for each cost center during the:
- a. Calendar year.
 - b. Month.
 - c. Fiscal Year.
 - d. Quarter.
- Ans. C Page nr. 6-5, cur.; 6-9, exp.
2. When preparing an IWP Job Order for contract maintenance services for repair of a motor, the work authorization specialist also prepares an:
- a. AF Form 332.
 - b. AF Form 9.
 - c. AF Form 1135.
 - d. AF Form 1445.
- Ans. B Page nr. 6-10, cur; 6-9, exp.
3. The Housing Management Office is notified of completion of renovation Job Orders by the:
- a. Scheduler.
 - b. Controller.
 - c. Family housing maintenance foreman.
 - d. Service Call specialist.
- Ans. B Page nr. 6-19, cur.; 6-19, exp.
4. The decision to process work as an IWP JO rather than as an IWP Work Order or some other work avenue is made by:
- a. The IWP programmer.
 - b. The work authorization specialist.
 - c. The Chief of Program Development.
 - d. None of the above.
- Ans. C Page nr. 6-5, cur.; 6-9, exp.

5. The work order number block on the SMART Job Order form, AF Form 1219 is supposed to contain:

- a. An Individual Work Order Number.
- b. A Collection Work Order Number.
- c. A Job Order Number.
- d. A Collection Job Order Number.

Ans. B Page nr. 6-16 or 6-17, cur.; 6-16 or 6-25, exp.

6. When scheduling Hopper Job Orders, prior to the weekly scheduling meeting, Work Control groups the Job Orders by:

- a. Number of estimated man-hours.
- b. Skills required.
- c. Type of materials needed.
- d. Time of day the calls were received.

Ans. B Page nr. 6-14, cur.; 6-13, exp.

7. FAST Job Orders are scheduled as work packages. The work packages are prepared in two sets. The two sets are for:

- a. Schedulers and controllers.
- b. Foremen and schedulers.
- c. Controllers and foremen.
- d. Craftsmen and foremen.

Ans. C Page nr. 6-11, cur.; 6-13, exp.

8. The _____ notifies the controller of completion and reports actual man-hours used on an IWP JO.

- a. Scheduler.
- b. Foreman.
- c. Craftsman.
- d. Planner.

Ans. C Page nr. 6-8, cur.; 6-15, exp.

9. When completed, the controller sends Hopper Job Orders which originated in Program Development to:

- a. Chief of Program Development.
- b. Scheduler.
- c. IWP programmer.
- d. Work authorization specialist.

Ans. D Page nr. 6-14, cur.; 6-15, exp.

10. When the planner determines that extra cost centers are needed for an IWP Job Order he:

- a. Assigns Job Order numbers.
- b. Requests the work authorization specialist to initiate additional AF Forms 1879 as required.
- c. Cross references each Job Order to the others.
- d. Sends the JO back to the IWP programmer for proper processing.

Ans. C Page nr. 6-5, cur.; 6-10, exp.

11. When doing SMART work, if an item cannot be finished due to lack of supplies, the craftsman:

- a. Draws a line thru the item on the AF Form 1219.
- b. Calls the controller for instructions.
- c. Checks the incomplete work column of AF Form 1219.
- d. Puts his initials in the "incomplete work" column.

Ans. C Page nr. 6-16, cur.; 6-17, exp.

12. Suppose it is found when doing an IWP JO, that extra supplies are needed which are not in bench stock. The foreman lists the needed items on his copy of the Job Order and sends it to:

- a. The Chief of Work Control.
- b. Material Control.
- c. Program Development.
- d. The controller.

Ans. D Page nr. 6-8, cur.; 6-14, exp.

13. FAST Job Orders are scheduled:

- a. As soon as received.
- b. Weekly.
- c. At the start of each work day.
- d. Every two days.

Ans. C Page nr. 6-11, cur.; 6-13, exp.

14. Job Orders for military family housing renovation are approved by the:

- a. Housing Management Office.
- b. Chief of Programs.
- c. Planning technician.
- d. Work authorization specialist.

Ans. B Page nr. 6-19, cur.; 6-18, exp.

15. Suppose an IWP Job Order has been completed. When the work authorization specialist receives the completed AF Form 1879 from the controller, he:

- a. Enters the current date in column M of the Job Order Log, AF Form 1880.
- b. Files the AF Form 1879 in the completed file.
- c. Discards the 1879.
- d. None of the above.

Ans. A Page nr. 6-8, cur.; 6-15, exp.

16. For IWP Job Orders, the IWP programmer:

- a. Determines if the IWP programming avenue is the most feasible.
- b. Checks to see if the work can be combined with other work.
- c. Prepares the AF Form 1135.
- d. Logs the Job Order on AF Form 1880.

Ans. B Page nr. 6-5, cur.; 6-9, exp.

17. When processing an IWP Job Order, who identifies the materials needed?

- a. The IWP programmer.
- b. The Material Control Specialist.
- c. The planner.
- d. The work authorization specialist.

Ans. C Page nr. 6-5, cur.; 6-10, exp.

18. How far ahead of the end of the current month does the work authorization specialist send IWP JOs to the Chief of Work Control?

- a. 15 days.
- b. Three weeks.
- c. 5 days.
- d. 2 days.

Ans. C Page nr. 6-8, cur; 6-11, exp.

19. Which copy of the IWP Job Order does the scheduler give to the controller?

- a. Original.
- b. Duplicate.
- c. Both copies.
- d. Neither, the controller does not get a copy.

Ans. B Page nr. 6-8, cur.; 6-11, exp.

20. When processing Hopper JOs, if the Chief of Work Control determines that the needed skills are not available he should:

- a. Return the JO to the customer.
- b. Schedule it as a Hopper JO.
- c. Decide the proper processing technique.
- d. Process the JO as a Service Call.

Ans. C Page nr. 6-14, cur.; 6-12, exp.

APPENDIX D
LETTER TO SELECTED SUBJECTS

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR BASE WING



DE

19 MAY 1977

Selection to Participate in a Research Experiment

See Attached Distribution List

1. A research experiment is being conducted to evaluate the communications effectiveness of AFR 85-1. The characteristics of AFR 85-1 that are being studied are those involving the format, layout, choice of words, organization of material, and the length and structure of sentences. The contents of AFR 85-1 are not being evaluated in this research but only the way the contents are presented.
2. A portion of AFR 85-1 has been rewritten by the researchers in a different style and format. The objective of the research is to determine if the rewritten version is as good as, better than, or worse than the current version of AFR 85-1 in terms of communications effectiveness.
3. You have been selected to participate in this experiment. Your involvement will consist of answering some multiple choice questions about the contents of the two versions of AFR 85-1. The results of each participant's involvement will be anonymous as no names will be identified with any of the data collected.
4. Your cooperative participation in this important research is strongly encouraged and is being counted on. You are asked to assemble in the DE Training Room, Building , on 25 May 1977 at 1430 to participate in the experiment. The researchers conducting this experiment are Mr. Michael P. Melby and Mr. Paul J. Palcic. If you have any questions, please call me. Thank you for your cooperation.

Deputy Staff Civil Engineering Officer



Selection to participate in a research project

See attached distribution list

1. A research project is being conducted in which the results of the project will be used to determine the effectiveness of a new method of training. The project is being conducted by the Department of the Air Force, and the results of the project will be used to determine the effectiveness of a new method of training. The project is being conducted by the Department of the Air Force, and the results of the project will be used to determine the effectiveness of a new method of training.

APPENDIX E

INSTRUCTIONS TO PARTICIPANTS

1. The purpose of this project is to determine the effectiveness of a new method of training. The project is being conducted by the Department of the Air Force, and the results of the project will be used to determine the effectiveness of a new method of training. The project is being conducted by the Department of the Air Force, and the results of the project will be used to determine the effectiveness of a new method of training.

2. The project is being conducted by the Department of the Air Force, and the results of the project will be used to determine the effectiveness of a new method of training. The project is being conducted by the Department of the Air Force, and the results of the project will be used to determine the effectiveness of a new method of training. The project is being conducted by the Department of the Air Force, and the results of the project will be used to determine the effectiveness of a new method of training.

Instructions to Participants

General Instructions - Both Groups

Before we get started we would like to thank each of you for being here to participate in this experiment. It is believed that research of this type is extremely important in keeping the Air Force effective and up to date. Although your responses will be anonymous, we hope you will be motivated to do the best you can so the results of the experiment will be valid.

The purpose of this experiment is to compare the communicating capability of two quite different ways of writing Air Force procedures. What is being looked for is to find out if an experimental version of a selected AF regulation is as good as the current way of writing, or if it is better or worse than the current way. The scope of the experiment is not intended to question how good the contents of the regulation are. What it does question is the way the contents are presented to the reader. The particular regulation used in this experiment is AFR 85-1, which should be familiar to most of you. Specifically, we will be dealing with part of Chapter 6, which is about Job Orders.

We're going to ask you to look up the answers to

some multiple choice questions, first using one of the writing styles as a reference, and then the other. The procedure is to first give you a selected part of Chapter 6 from the current (or re-written, if Group B) version of AFR 85-1. We will explain briefly how it is structured and give some comments on its use as a reference. You will then have 5 minutes to scan this regulation to become familiar with what's in it and how its laid out. Then you will be asked to complete a set of multiple choice questions using the current (or re-written, if Group B) version of AFR 85-1 as your reference.

After that, we will give you an experimental (or current, if Group B) version of the same procedures and we will go through the same basic steps. The final item will be a short opinion survey. The entire experiment shouldn't take more than about one hour and 15 minutes.

For general background information, let's take just a minute or two to talk about Chapter 6. Chapter 6 describes the various types of Job Orders used in Base Civil Engineering, the Air Force Forms involved, the general concepts of when and how a Job Order should be used, and the specific procedures for each person involved in Job Order processing. Five distinct types of Job Orders are discussed in Chapter 6. They are: Fast Action Service Technique (FAST) Job Orders, Hopper Job Orders, In Service

Work Plan (IWP) Job Orders, Structural Maintenance and Repair Team (SMART) Job Orders, and Military Family Housing (MFH) Renovation Job Orders.

The chapter describes the duties of each of the people involved with Job Order processing and accomplishment. This includes such people as planners, schedulers, programmers, foremen, and controllers, among others.

The processes described are basically: the initial processing of each type of Job Order, how each type is scheduled, how each type of Job Order is accomplished and what to do when the work is finished. Although Chapter 6 includes terms, concepts, compliance items and optional procedures, we are only going to deal with the last part which contains the optional procedures.

Group A Instructions

(Pass out current AFR 85-1 Chapter 6)

To get everyone equally familiar with the contents we will take a minute to scan together the layout of the chapter. Beginning with para 6-13 on page 6-5 are the procedures for programming and processing IWP type Job Orders. These are continued on page 6-8, 6-8.1 and on top of page 6-10. Then, beginning with para 6-14 on page 10, are the procedures for FAST and Hopper Job Orders. These go through to the bottom of page 14. On this same page, in para 6-15, the procedures for SMART Job Orders are

described. These go through to page 19, where, in para 6-16 the MFH renovation Job Orders are described. Also included is an alphabetical index where the reference is given by paragraph numbers. When answering a question you might find it helpful to first find out what kind of job order you are talking about, and locate that section in the regulation. Then, narrow it down to what part of the process is being talked about, such as initial processing, scheduling, or completion; and then, find the specific person or action being looked for.

The next 5 minutes have been set aside for you to scan this regulation and become familiar with it.

(Pass out Part I)

Please be aware that there are no trick questions. Pick out the best answer to each question. If you really get stuck on a question, it might be better to skip it and go on to the next one. Try to answer as many as you can, but please don't get concerned if you don't get them all answered. Most people will probably not have time to answer all of the questions. To record your answer, write in the letter of the correct answer and the page number where you found the answer. We ask you to be as fair as possible and not try harder on one part or another of the experiment so as to make either version look better.

This would only cause the validity of the experiment to be lowered. You will have twenty minutes for this part of the experiment. Please begin now to answer the multiple choice questions.

(After twenty minutes collect Part I and the current version of AFR 85-1.)

(Pass out Experimental AFR 85-1)

Again, for familiarity, we will scan the contents together. Notice that the left hand column contains the job title of the individual responsible for an action and the right hand column tells what action they have to do.

Next, when you see a box with the actions listed in it, there is a particular way it should be read. For example, on page 6-15, item 3: First you read down the left column of the box to find which category fits what you are looking for. This downward reading is indicated by the downward arrow above that column. Then, you read across from the correct "if category" to find the correct action. For example, if the Job Order was a Hopper JO, and it initially came from Program Development, then the controller, in this case, would send it back to the work authorization specialist.

Now, beginning with paragraph 6-9 on page 6-9 are the procedures for initial processing of IWP Job Orders.

These procedures are continued through page 11. In para 6-10 on page 11 the procedures for IWP Job Order Scheduling are described. On this same page, in para 6-11 the initial processing procedures for the FAST and Hopper Job Orders begin. These procedures continue through the bottom of page 12. The scheduling procedures for FAST are found in para 6-12 on page 13. The scheduling procedures for Hopper Job Orders start on the same page in para 6-13 and continue through page 14. Paragraph 6-14 on page 14 describes procedures to be followed in obtaining extra supplies during work progress for either a FAST, a Hopper, or an IWP Job Order. Para 6-15 on page 15 describes the actions to be taken upon completion of FAST, Hopper, or IWP Job Orders. Para 6-16 on page 15 describes the initial processing and scheduling of SMART Job Orders. These procedures continue through page 17. Para 6-17 on this page describes the procedures to be followed when supplies run out or work is added during work progress on a SMART Job Order. Para 6-18 on page 17 describes the actions to be taken upon completion of SMART Job Orders. These actions continue on the top of page 18. Para 6-19 starts on page 18 and describes all procedures for Military Family Housing Renovation, these continue through page 19.

When answering a question you might find it helpful to first find out what kind of job order you are talking about, and locate that section in the regulation. Then

narrow it down to what part of the process is being talked about, such as initial processing, scheduling, or completion; and then find the specific person or action being looked for. The table of contents on the very first page should be helpful in locating the part of the process you are looking for.

The next 5 minutes have been set aside for you to scan this regulation and become familiar with it.

(Pass out Part II)

Again, there are no trick questions. Pick out the best answer to each question. If you really get stuck on a question it might be better to skip it and go on to the next one. Try to answer as many questions as you can but please don't get concerned if you don't get them all answered. Most people will probably not have time to answer all of the questions. To record your answer, write in the letter of the correct answer and the page number where you found the answer. We ask you to be as fair as possible and not try harder on one part or another so as to make either version look better. This would only cause the validity of the experiment to be lowered. You will have twenty minutes for this part of the experiment. Please begin now to answer the multiple choice questions.

(After 20 minutes, collect Part II and the experimental

AFR 85-1.)

(Pass out opinion surveys)

The final portion of the experiment is a short opinion survey. Take as much time as you need (or can spare). Your answers to these opinion survey questions will be very valuable to the success of this research. Thank you very much for participating with us in this experiment.

(Collect surveys - no time limit)

Group B Instructions

(Pass out Experimental AFR 85-1)

To get everyone equally familiar with the contents we will take a minute to scan together the layout of the chapter. Notice that the left hand column contains the job title of the individual responsible for an action and the right hand column tells what action they have to do.

Next, when you see a box with the actions listed in it, there is a particular way it should be read. For example, on page 6-15, item 3: First you read down the left column of the box to find which category fits what you are looking for. This downward reading is indicated by the downward arrow above that column. Then, you read across from the correct "if category" to find the correct action. For example, if the Job Order was a Hopper JO, and it

initially came from Program Development, then the controller, in this case, would send it back to the work authorization specialist.

Now, beginning with paragraph 6-9 on page 6-9 are the procedures for initial processing of IWP Job Orders. These procedures are continued through page 11. In para 6-10 on page 11 the procedures for IWP Job Order Scheduling are described. On this same page, in para 6-11 the initial processing procedures for the FAST and Hopper Job Orders begin. These procedures continue through the bottom of page 12. The scheduling procedures for FAST are found in para 6-12 on page 13. The scheduling procedures for Hopper Job Orders start on the same page in para 6-13 and continue through page 14. Paragraph 6-14 on page 14 describes procedures to be followed in obtaining extra supplies during work progress for either a FAST, a Hopper, or an IWP Job Order. Para 6-15 on page 15 describes the actions to be taken upon completion of FAST, Hopper, or IWP Job Orders. Para 6-16 on page 15 describes the initial processing and scheduling of SMART Job Orders. These procedures continue through page 17. Para 6-17 on this page describes the procedures to be followed when supplies run out or work is added during work progress on a SMART Job Order. Para 6-18 on page 17 describes the actions to be taken upon completion of SMART Job Orders. These actions continue on the top of page 18. Para 6-19

starts on page 18 and describes all procedures for Military Family Housing Renovation, these continue through page 19.

When answering a question you might find it helpful to first find out what kind of job order you are talking about, and locate that section in the regulation. Then narrow it down to what part of the process is being talked about, such as initial processing, scheduling, or completion; and then find the specific person or action being looked for. The table of contents on the very first page should be helpful in locating the part of the process you are looking for.

The next 5 minutes have been set aside for you to scan this regulation and become familiar with it.

(Pass out Part I)

Please be aware that there are no trick questions. Pick out the best answer to each question. If you really get stuck on a question, it might be better to skip it and go on to the next one. Try to answer as many as you can, but please don't get concerned if you don't get them all answered. Most people will probably not have time to answer all of the questions. To record your answer, write in the letter of the correct answer, and the page number where you found the answer. We ask you to be as fair as possible and not try harder on one part or another of

the experiment so as to make either version look better. This would only cause the validity of the experiment to be lowered. You will have twenty minutes for this part of the experiment. Please begin now to answer the multiple choice questions.

(After twenty minutes collect Part I and the experimental version of AFR 85-1.)

(Pass out current AFR 85-1 Chapter 6)

Again, for familiarity, we will scan the contents together. Beginning with para 6-13 on page 6-5 are the procedures for programming and processing IWP type Job Orders. These are continued on page 6-8, 6-8.1 and on top of page 6-10. Then, beginning with para 6-14 on page 10, are the procedures for FAST and Hopper Job Orders. These go through to the bottom of page 14. On this same page, in para 6-15, the procedures for SMART Job Orders are described. These go through to page 19, where, in para 6-16 the MFH renovation Job Orders are described. Also included is an alphabetical index where the reference is given by paragraph numbers. When answering a question you might find it helpful to first find out what kind of job order you are talking about, and locate that section in the regulation. Then, narrow it down to what part of the process is being talked about, such as initial processing,

scheduling, or completion; and then, find the specific person or action being looked for.

The next 5 minutes have been set aside for you to scan this regulation and become familiar with it.

(Pass out Part II)

Again there are no trick questions. Pick out the best answer to each question. If you really get stuck on a question, it might be better to skip it and go on to the next one. Try to answer as many as you can but don't get concerned if you don't get them all answered. Most people will probably not have time to answer all of the questions. To record your answer, write in the letter of the correct answer, and the page number where you found the answer. We ask you to be as fair as possible and not try harder on one part or another so as to make either version look better. This would only cause the validity of the experiment to be lowered. You will have twenty minutes for this part of the experiment. Please begin now to answer the multiple choice questions.

(After 20 minutes, collect Part II and the current AFR 85-1.)

(Pass out opinion surveys)

The final portion of the experiment is a short opinion

survey. Take as much time as you need (or can spare).
Your answers to these opinion survey questions will be
very valuable to the success of this research. Thank
you very much for participating with us in this experi-
ment.

(Collect surveys - no time limit)

survey. Take as much time as you need (or can spare).
Your answers to these opinion survey questions will be
very valuable to the success of this research. Thank
you very much for participating with us in this experi-
ment.

(Collect surveys - no time limit)

APPENDIX F
DESCRIPTION OF STUDENT'S T
TEST FOR PAIRED DATA

A test of statistical significance is necessary to determine if the means of two samples indicate that the samples were drawn from the same universe (or universes with identical means). If the two samples have means of \bar{X} and \bar{Y} a null hypothesis may be stated as $H_0: \mu_X = \mu_Y$ (or $\mu_X \leq \mu_Y$). If this hypothesis is not rejected a decision has been made that the two samples have been drawn from a single universe or universes with identical means and that any difference in the sample means is a sampling difference and is therefore not significant. However, if H_0 is rejected and H_1 is accepted, the conclusion is reached that the difference between \bar{X} and \bar{Y} is too large to be explained as a sampling difference alone, and that, therefore, the samples were drawn from two universes with different means (5:351). When the universe standard deviations are not known but assumed to be equal, the sample standard deviations must be used as estimates. In these cases the theoretical sampling distribution of differences is assumed to follow a student's t distribution with a mean equal to zero and a standard deviation that is the estimated standard error of the difference (5:353). Then with $H_0: \mu_X \leq \mu_Y$ and $H_1: \mu_X > \mu_Y$, a test would reject H_0 if the sample t statistic (t_s) was less than the critical t statistic (t_c) (5:354). Although the normal distribution is usually used for statistical

tests of the type described above, when the universe standard deviation is not known the student's t distribution is used for greater accuracy (5:265). When paired values are used, the difference $D_i = X_i - Y_i$ is calculated for each pair of data and the differences D_i are treated as a single sample (29:171). For a test of the null hypothesis that the two treatments (versions of AFR 85-1) produce the same results (same test scores) we compute $t_s = \bar{D}/S_{\bar{D}}$ with degrees of freedom = $n-1$ (n = number of pairs) where \bar{D} is the mean of the differences between the two samples and (24:95).

GUNNING FOG INDEX DESCRIPTION

DESCRIPTION OF THE GUNNING FOG INDEX

Gunning maintains that the reading difficulty of a piece of prose can be measured by (1) the average length of sentence, and (2) the percent of words of three syllables or more per 100 words of text. These two measures obviously give only an approximation of readability; in fact, readability also depends upon the interest-holding ability of the topic, the familiarity of the reader with specific words being used, and the care with which the sentences are constructed. For a rough measure of readability, however, the Fog Index has some value (7:426-7).

To compute the Fog Index:

1. Divide total number of words (minimum of 100) by the number of sentences.
2. Count the number of words with three syllables or more per 100 words. Don't count: (a) capitalized words, (b) combinations of short easy words like "bookkeeper" or "butterfly", (c) verbs made into three syllables by adding "ed" or "es".
3. Add the two above factors and multiply by 0.4.

This gives the Fog Index which is roughly equivalent to the years of schooling a person would need to read the passage with ease and understanding.

APPENDIX H
OPINION SURVEY

OPINION EVALUATION OF REWRITTEN AFR 85-1

Evaluator # _____.

Please complete the following items to help with the evaluation of this experimental writing style. You are now the experts in its use, therefore your opinions are highly valuable.

Please rate questions 1 thru 6 by placing an "X" along the line at the point that represents your opinion.

1. CLARITY: Rate the clarity of the experimental version of AFR 85-1 for your on-the-job needs, compared to the current version of AFR 85-1.

Much more
confusing than
current AFR 85-1

Not much
different

Much clearer
than current
AFR 85-1

2. DECISION LOGIC TABLES: Compare the decision logic tables (the boxes with "IF" headings) with the narrative technique used in the current AFR 85-1.

Much more
confusing than
current AFR 85-1

Not much
different

Much clearer
than current
AFR 85-1

3. FORMAT: Regarding the unusual format of the experimental version of AFR 85-1, did you find that having the person responsible shown in the left hand column and the actions in the right hand column makes it easier to find information than in the current AFR 85-1?

Much more
difficult to
find information

Not much
different

Much easier to
find information

4. Disregarding the cost of re-writing, how much better would it be if all applicable Air Force manuals and regulations were re-written using the new writing techniques?

Much worse than
the current
situation

No difference

Much better

5. Disregarding the cost of re-writing, how much better would it be if all applicable local operating instructions (OIs) and (SOPs) were re-written using the new writing techniques?

Much worse than the current situation |-----| No difference |-----| Much better

6. Based on the number of questions you answered on Part I and Part II, how do you feel about the validity of this experiment as an evaluator of the benefits of the new writing techniques?

Not valid. Didn't show how good the new techniques really are. |-----| Don't know |-----| Very valid. Should be a good predictor of success

Please answer questions 7 thru 9 in the space provided below each question. If more space is needed turn the paper over.

7. Would you like to see the entire AFR 85-1 written in the new format? Why or why not?

8. Is there anything about the experimental version of AFR 85-1 that "turned you off" or "turned you on" as far as wanting or not wanting to use it rather than the current AFR 85-1?

9. Do you have any suggestions about how to improve the experimental version of AFR 85-1? Please think about this for a moment because your suggestions would be very valuable.

DETAILED RESULTS OF JOB KNOWLEDGE TEST PART I

Group A - Current AER 12-1

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Subject	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

APPENDIX I

DETAILED JOB KNOWLEDGE TEST RESULTS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----

A, B, C, D - Indicate subject's response.

1 - Indicate incorrect answer because of page number.

2 - Indicate subject did not answer question.

X - Indicate correct answer and correct page number.

* Scores not used due to incomplete participation.

Subject finished 5 minutes early.

DETAILED RESULTS OF JOB KNOWLEDGE TEST
PART I

Group A - Current AFR 85-1

Question																					
		1	2	3	4	5	6	7	8	9	1	1	1	1	1	1	1	1	1	1	2
Subject		1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
1		X	P	C	A	X	X	X	P	X	X	X	A	X	X	0	0	0	0	0	0
2		X	X	X	X	X	X	X	X	X	D	X	X	0	0	0	0	0	0	0	0
3		X	X	X	X	X	X	X	D	X	X	C	0	0	0	0	0	0	0	0	0
4		X	X	X	X	X	X	X	X	X	A	D	0	A	X	0	0	0	0	0	0
5		X	X	X	X	X	D	X	X	X	0	0	0	0	0	0	0	0	0	0	0
6		X	X	X	A	X	X	X	X	X	X	X	X	X	X	X	X	P	0	0	0
7		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	0
8		X	X	X	A	X	D	X	X	X	D	A	P	0	0	0	0	0	0	0	0
9		A	0		A	C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10		X	X	P	X	X	X	X	P	X	D	D	X	P	A	0	0	0	0	0	0
11		X	X	X	X	X	X	X	X	X	X	X	B	0	0	0	0	0	0	0	0
12		X	X	X	X	X	X	X	X	X	X	X	B	X	X	0	0	0	0	0	0
13		X	X	X	X	X	X	X	X	A	X	X	0	X	X	0	0	0	0	0	0

Group B - Experimental AFR 85-1

14		X	0	C	X	X	X	X	X	0	0	0	0	0	0	0	0	0	0	0	0
15		X	A	B	X	C	X	X	X	X	P	B	X	X	0	0	0	0	0	0	0
16		*X	X	X	A	X	X	X	X	X	X	X	X	X	X	0	X	X	X	X	X
17		**X	X	B	B	X	X	X	X	X	X	X	X	X	0	X	X	X	X	X	X
18		X	A	B	A	C	X	0	0	X	X	0	X	0	0	0	0	0	0	0	0
19		A	X	0	X	C	D	X	D	A	X	D	0	X	0	0	0	0	0	0	0
20		X	A	X	X	X	X	X	X	X	X	A	A	A	X	X	X	0	0	0	0
21		A	C	X	X	X	X	X	X	X	X	X	A	X	0	0	0	0	0	0	0
22		A	X	X	X	X	X	X	0	X	C	A	A	C	0	0	0	0	0	0	0
23		X	D	C	X	X	X	X	D	X	D	A	P	C	X	X	X	0	0	0	0

Key:

A, B, C, D - Indicate subjects' incorrect responses.

P - Indicates incorrect answer because of page number.

0 - Indicates subject did not answer question.

X - Indicates correct answer and correct page number.

* Scores not used due to incomplete participation.

** Subject finished 6 minutes early.

DETAILED RESULTS OF JOB KNOWLEDGE TEST
PART II

Group A - Experimental AFR 85-1

Question																				
	1	2	3	4	5	6	7	8	9	1	1	1	1	1	1	1	1	1	1	2
Subject	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
1	X	X	X	X	X	X	X	X	X	B	X	X	X	0	X	X	X	X	X	X
2	X	X	X	X	X	X	P	X	X	B	X	X	X	0	X	X	0	0	0	0
3	X	X	X	P	D	X	X	0	B	0	0	0	0	0	0	0	0	0	0	0
4	X	X	0	0	0	X	X	P	0	0	P	0	X	0	0	0	X	X	X	0
5	B	X	X	X	0	X	X	P	0	D	X	B	X	D	X	X	X	X	A	0
6	A	X	X	X	X	X	X	X	0	X	X	X	P	P	0	0	0	0	0	0
7	X	X	X	X	0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
8	X	X	X	A	X	P	A	P	A	B	X	A	B	A	X	P	X	X	X	0
9	X	X	X	X	0	X	X	0	0	0	0	0	0	0	0	0	0	0	0	0
10	X	D	X	X	X	A	P	P	0	P	B	A	P	X	P	0	0	0	0	0
11	X	X	X	X	0	X	X	X	X	B	X	0	X	0	0	0	0	0	0	0
12	X	X	X	X	X	X	X	X	0	X	X	X	X	X	B	X	X	X	X	X
13	X	X	X	X	X	X	X	0	0	B	X	B	0	0	0	0	0	0	0	0

Group B - Current AFR 85-1

14	X	P	0	A	X	0	0	X	0	0	0	0	0	0	0	0	0	0	0	0
15	A	X	X	A	X	A	X	B	B	B	X	X	X	0	0	0	0	0	0	0
16	*0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	**X	X	X	X	X	X	X	X	P	C	0	A	X	X	X	X	X	0	A	X
18	X	C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	P	C	B	P	X	X	P	B	B	D	A	0	0	0	0	0	0	0	0
20	X	X	X	X	A	P	X	X	C	0	0	0	0	X	X	0	0	X	A	X
21	X	X	X	X	X	C	X	P	B	B	0	0	D	A	X	A	X	X	0	0
22	X	X	X	X	X	P	X	X	X	B	X	X	D	0	0	0	0	0	0	0
23	X	X	X	X	X	P	X	X	X	B	X	X	X	X	0	0	0	0	0	0

Key:

A, B, C, D - Indicate subjects' incorrect responses.

P - Indicates incorrect answer because of page number.

0 - Indicates subject did not answer question.

X - Indicates correct answer and correct page number.

* Scores not used due to incomplete participation.

** Subject finished 1 minute early.

DETAILED SUMMARY OF THE RESEARCH TEST PART II

Group A - Experimental Set B-

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Subject	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

APPENDIX J

MATHEMATICAL CORRECTION OF RESEARCH WEAKNESSES

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----

This appendix presents supporting details to show how research weaknesses 7 and 8 (see pages 63 and 64) were mathematically corrected. The tables presented herein are recomputed versions of the original tables presented on pages 40 and 41. Reference notes in the tables explain what changes were made in the data to correct for these two research weaknesses.

CORRECTED TABLE III

COMPUTATIONS FOR STATISTICAL ANALYSIS OF TEST SCORES

Subjects	Test Scores Experimental AFR 85-1 (X)	Test Scores Current AFR 85-1 (Y)	D_1	\bar{D}	$D_1 - \bar{D}$	$(D_1 - \bar{D})^2$
1	90	45	45	6.67	38.33	1469.19
2	65	55	10	6.67	3.33	11.09
3	25	45	-20	6.67	-26.67	711.29
4	40	50	-10	6.67	-16.67	277.89
5	55	40	15	6.67	8.33	69.39
6	50	75	-25	6.67	-31.67	1002.99
7	95	95	0	6.67	- 6.67	44.49
8	45	35	10	6.67	3.33	11.09
9	30	5	25	6.67	18.33	335.99
10	25	40	-15	6.67	-21.67	469.59
11	50	55	- 5	6.67	-11.67	136.19
12	90	65	25	6.67	18.33	335.99
13	40	60	-20	6.67	-26.67	711.29
14	30	15	15	6.67	8.33	69.39
15	40	35	5	6.67	- 1.67	2.79
*16	--	--	--	--	--	--
17	120 ⁽¹⁾	75 ⁽²⁾	45	6.67	38.33	1469.19
18	25	5	20	6.67	13.33	177.69
19	25	10	15	6.67	8.33	69.39
20	65	50	15	6.67	8.33	69.39
21	55	45	10	6.67	3.33	11.09
22	40	50	-10	6.67	-16.67	277.89
23	50	60	-10	6.67	-16.67	277.89
24	46.11 ⁽³⁾	37.78 ⁽⁴⁾	8.33	6.67	1.66	2.76
25	46.11 ⁽³⁾	37.78 ⁽⁴⁾	8.33	6.67	1.66	2.76
26	46.11 ⁽³⁾	37.78 ⁽⁴⁾	8.33	6.67	1.66	2.76
27	46.11 ⁽³⁾	37.78 ⁽⁴⁾	8.33	6.67	1.66	2.76
						8022.22

$$\bar{X} = 51.3246 \quad \bar{Y} = 44.6585 \quad \bar{D} = 6.67$$

* Scores not used due to incompleted participation.

NOTES:

(1) Computed on the basis of correct answers per minute.

The subject completed the test using experimental AFR 85-1

in 14 minutes, or 6 minutes early. In the 14 minutes used to complete this portion of the test the subject correctly answered 17 questions or 1.2 questions per minute. If there had been sufficient questions on the test to keep the subject working for the full 20 minutes allotted for the test it is believed the subject would have answered (20×1.2) or 24 questions correctly. This would equate to a test score of 120.

(2) Computed on the basis of correct answers per minute. The subject completed the test using the current AFR 85-1 in 19 minutes, or 1 minute early. In the 19 minutes used to complete this portion of the test the subject correctly answered 14 questions or .74 questions per minute. If there had been sufficient questions on the test to keep the subject working for the full 20 minutes allotted for the test it is believed the subject would have answered $(20 \times .74)$ or approximately 15 questions correctly. This would equate to a test score of 75.

(3) The double change-over technique used in this experiment requires the groups taking the tests to be of equal size in order that possible bias from unequal tests or unequal group characteristics can be eliminated. In order to make the groups equal, 4 simulated subjects were added to Group B. It was assumed that these subjects could attain the average score achieved by the 9 actual subjects in Group B. The average score was obtained from

Table II, page 40.

(4) The same logic used in note 3 above applies here. Again, the average score attained by Group B on this test was assumed to be achieved by the 4 additional subjects. The average score was obtained from Table II, page 40.

Using the methodology in Chapter 3 and the above data the test statistic (t_s) is computed as 1.90. The critical statistic t_c was extracted from statistical tables for the students' t distribution ($\alpha = .05$, one-tail) as 1.721. In the hypothesis test:

$$H_0: \mu_x \leq \mu_y$$

$$H_1: \mu_x > \mu_y$$

t_s was greater than t_c therefore there is sufficient evidence to reject H_0 at the 95% level of significance.

CORRECTED TABLE II

MEAN TEST SCORES BY GROUP

	Group A	Group B	Overall
Mean Score Current AFR 85-1	51.15	36.16 ⁽¹⁾	44.66 ⁽³⁾
Mean Score Experimental AFR 85-1	53.85	48.80 ⁽²⁾	51.32 ⁽³⁾
Percent Improvement	*5.28	27.88	14.9% ⁽³⁾

* computed as $[(53.85 \div 51.15) - 1] \times 100$

NOTES:

- (1) Computed as the mean of test scores (experimental AFR 85-1) for subjects 14 through 27.
- (2) Computed as the mean of test scores (current AFR 85-1) for subjects 14 through 27.
- (3) Reference the values for \bar{X} and \bar{Y} in the preceding CORRECTED TABLE III.

NOTES

- (1) Computed as the mean of test scores (experimental)
- APR 85-1) for subjects 14 through 17
- (2) Computed as the mean of test scores (control APR
- 85-1) for subjects 14 through 17
- (3) Reference to values for X and Y in the preceding
- CONNECTED TABLE

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